

The closest relationship between allopatric species is the one seen between *P. ovalifolia* in the Chinese-Indo-Chinese area and *P. elliptica*, *P. dispar*, *P. brookei*, and *P. rupicola* in Borneo.

In the Bornean area there is a centre of distribution in Sarawak, and in the Malayan-Sumatran area a centre occurs in West Malaysia (*P. rotundifolia* and *P. hispida* are the only species in Thailand and Sumatra). In the Chinese-Indo-Chinese area, Tonkin and the adjacent parts of Yunnan, Kwangsi, and Kwangtung together form a centre of distribution, where about twenty-one species occur. Annam is a minor centre peculiar in that its eight species are endemic.

In the general comments a few *nomina nuda* are used. They refer to Bornean taxa which are so far unpublished. Their present unpublished status is indicated by adding "ined."

CHARACTERISTICS AND DELIMITATION OF PHYLLAGATHIS

CHARACTERISTICS

The genus *Phyllagathis* may be recognized only by a number of characters in various combinations, i.e., no single character is shared by all the species. Important distinctive features are however found in the inflorescence (a compound or simple umbel, a thyrse with dichasial or scorpioid branches, or a simple dichasium), the anthers (connective morphology), the ovary (apical lobes, subsequently termed crown (see p. 361), placentas), and the old fruit (general morphology, abscission of seeds). Details are given below.

CRYSTAL-CONTAINING CELLS

The druse is the common crystal form in cells of the *Sonerileae*. Raphides were first recorded in *Fordiophyton* by DIELS (1932). VAN VLIET (1981) records raphides in the wood of *Bredia tuberculata*. It now appears that raphides also occur in six species of *Phyllagathis*: *P. guillauminii* in Vietnam (Annam), *P. ovalifolia* in China and Vietnam (Tonkin), and *P. elliptica*, *P. brookei*, *P. dispar*, and *P. rupicola* in Borneo. The raphides occur in cells both in vegetative and floral parts. They are rarely conspicuous, but may appear on the leaf surface as whitish or light coloured oblong spots.

MORPHOLOGY AND ANATOMY

Habit and growth. — The species of *Phyllagathis* are mostly acaulescent or caulescent perennial herbs. Less often they are shrublets, or rarely shrubs, with a branched (e.g., in *P. ovalifolia* and *P. stenophylla*), or unbranched, single-stemmed habit (e.g., in *P. tuberculata*). The herbaceous species may be erect, but usually a shorter or longer part of the stem may be prostrate and rooting. Extraordinary is the stoloniferous habit of *P. stolonifera* (KIEW, 1987).

Growth is sympodial and occurs from the buds in the axils of the uppermost leaf pair, i.e., from the leaf that subtends the inflorescence. It is dichasial, when both buds develop into new shoots, as in *P. dichotoma* or *P. setotheca*, but more often it is monochasial due to suppression of one of the buds (often in *P. rotundifolia*). In some species the buds may start growing into new shoots while the inflorescence is still flowering, and, when growth is monochasial, the terminal inflorescence is pushed aside and appears lateral. In other species, growth starts late so that even old infructescences appear terminal. WEBER (personal communication), however, has observed monopodial growth in the *P. tuberculata* alliance.

In *P. dichotoma*, *P. tentaculifera*, and *P. truncata*, located at the node on each side of the leaf bases, but slightly below them, is a small lobe-like elevation which becomes larger, but never conspicuous, and suberizes on older branches. Similar lobes have been observed in *Cyphotheca montana* (HANSEN, 1990).

The leaves are strictly opposite (see also below), but in the inflorescence some displacement may occur so that the two branches at a node arise at different levels (e.g., in *P. pulcherrima*). In *P. cordata* the inflorescence branches sometimes appear alternate. Generally the leaves in a pair are slightly unequal, rarely they are much unequal (in *P. suberalata* and *P. dispar*); a pronounced dimorphism of the two leaves as in species of *Driessenia* and *Sonerila*, however, does not occur. In some Bornean caulescent species with spike-like inflorescences one of the leaves in a pair may be completely suppressed (e.g., in *P. paucinodis* ined. and *P. suffruticosa* ined.). The same may be the case in the related subcaulescent species where, however, the condition is difficult to discern with certainty because of the short internodes and the thick, gnarled stems. Suppression may not be a correct interpretation; perhaps the subcaulescent species display an aberrant type of growth. The distinct basal part of the leaves in *P. scortechinii*, termed carriers by WEBER (1982), are an example of an aberrant type of growth. A complete suppression of one of the leaves is seen in specimens of *P. rotundifolia*.

The longitudinal nerves usually diverge at the base of the leaf blade, but sometimes the leaves are plinerved, i.e., at least the middle pair of nerves diverge somewhere above the base, shortly above it in most plinerved species, e.g., specimens of *P. praetermissa*, or high above it only in *P. tuberculata*, *P. magnifica*, and *P. stonei*.

KIEW et al. (1981) report leaf cuttings in *P. griffithii* and *P. rotundifolia*. They develop at the base of blades which have been severed from the petiole. Rooting leafblades are known elsewhere in *Brittenia* (HANSEN, 1985a) where new plants develop from old non-severed leaves rooting at their tips.

Indumentum. — The indumentum of the plant (which occurs on vegetative parts, the hypanthium, and sepals) may consist of one or more of the following components: minute usually gland-tipped hairs (or minute brown glands), ordinary hairs that may or may not be gland-tipped, and stout emergences (on the hypanthium only). In *P. marumiaetricha* a truly stellate indumentum occurs.

Though sometimes scarce, the minute brown glands have been observed in all species except *P. marumiaetricha*, and may occur on all parts of the plant. These glands are composed of a short, few-celled stalk and a few-celled glandular head, and are usually brown and bent. They correspond to a type illustrated by WURDACK (1986, Fig. 27-40) and termed minute uniseriate hairs. In *P. rotundifolia* (and much less distinct in a few other species) each cell of the

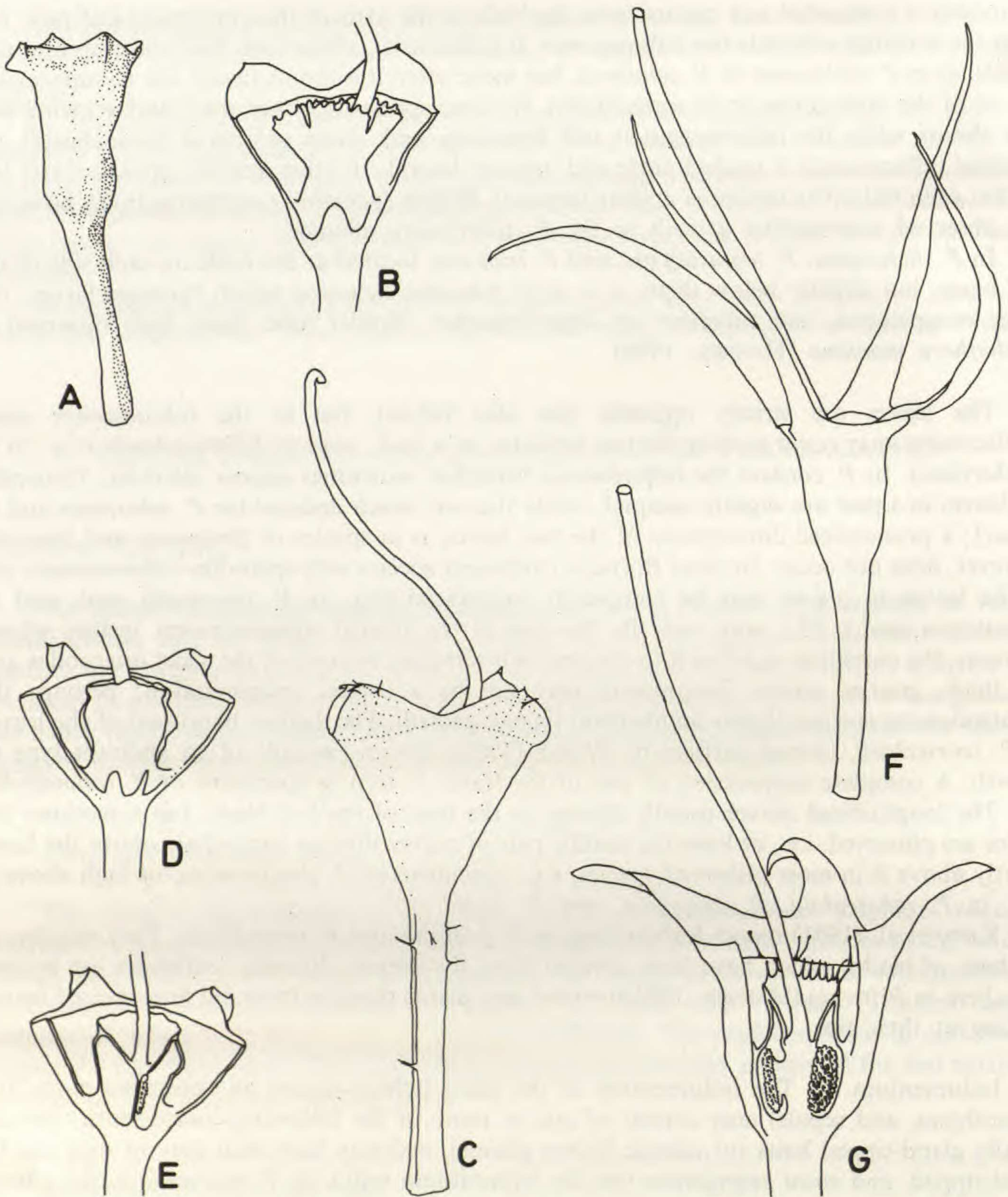


Fig. 1. — *Phyllagathis*, floral parts, ca. $\times 5$: A, *P. cavaleriei*, hypanthium and sepals (Cavalerie 56, P). — B, *P. tetrandra*, longitudinal section of hypanthium showing two sepals from the inside, anther pockets, and the apical part of the ovary with the crown; C, hypanthium and sepals, style protruding (Henry 10539, K). — D, *P. tonkinensis*, longitudinal section of hypanthium showing two sepals from the inside, anther pockets, and the ovary with the crown (Balansa 3520, P); E, as D, but the ovary and crown also sectioned, placenta shown in one locule. — F, *P. suberalata*, hypanthium and sepals, style protruding (Poilane 29758, P). — G, *P. melastomatoides*, longitudinal section of hypanthium, ovary and crown (How 72029, A).

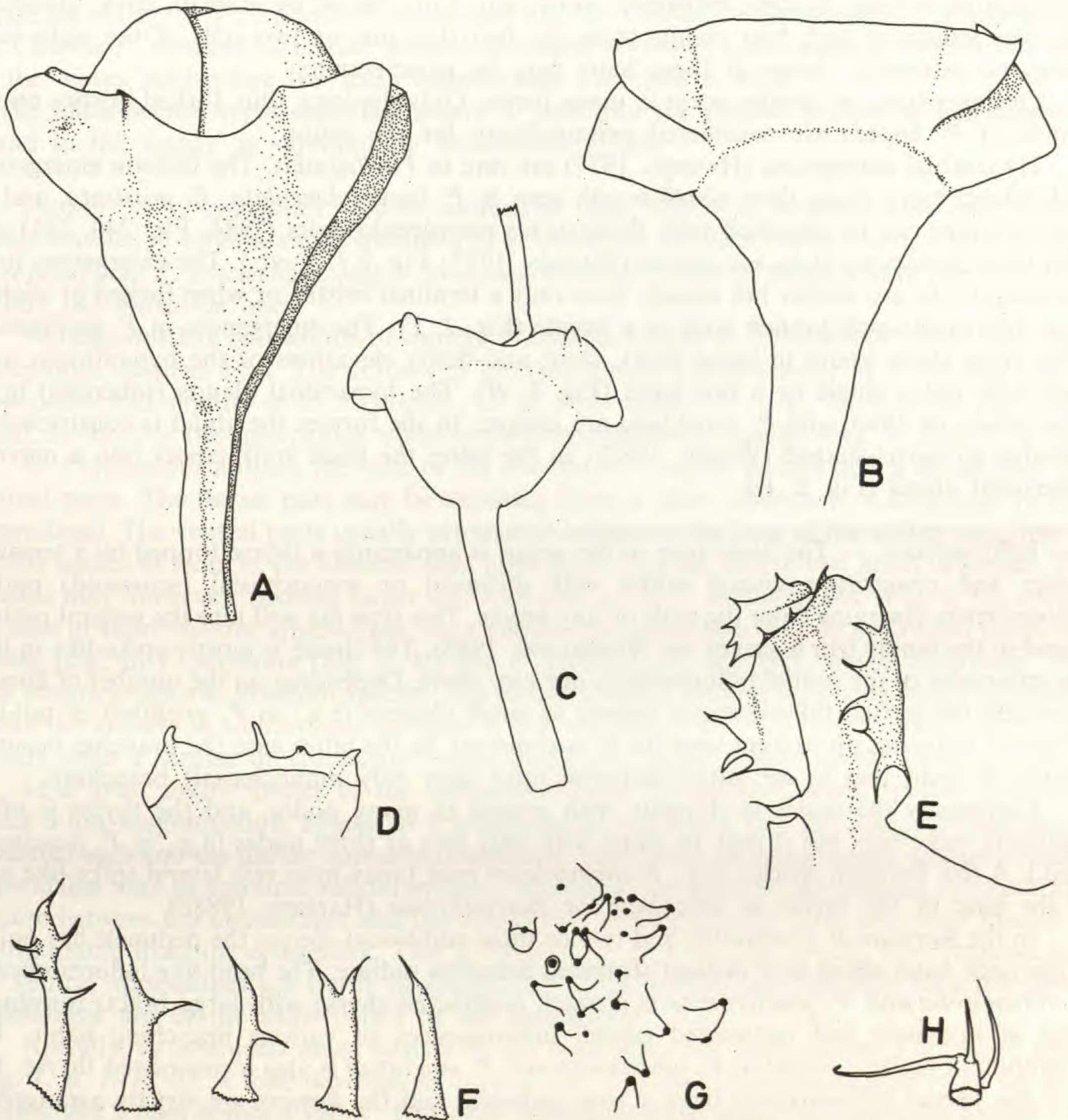


Fig. 2. — *Phyllagathis*, floral parts, ca. $\times 5$: A, *P. driessenioides*, bud (*Poilane 31799*, P). — B, *P. truncata*, hypanthium with the winged sepalous rim (*Poilane 6544*, P). — C, *P. megalocentra*, hypanthium and sepals (*Poilane 3584*, P). — D, *P. wenshanensis*, upper part of hypanthium with two intersepalous teeth in the sinus between two sepals (*Feng 11186*, A). — E, *P. marumiaetricha*, part of sepalous rim with one lobe seen obliquely from the back; F, hypanthial emergences (*Eberhardt 3056*, P). — G, *P. sessilifolia*, hypanthial emergences (*Poilane 28997*, P). — H, *P. guillauminii*, hypanthial emergence (*Pierre s.n.*, P).

head protrudes so that the head becomes stellate and resembles WURDACK's dendritic hairs (1986, Fig. 182). Rarely the minute brown glands occur also on bristles (e.g., in *P. rotundifolia* and *P. longifolia*). In *P. ovalifolia*, *P. elliptica* and related species a specific component of the indumentum is long, hyaline, brownish, uni-seriate hairs tipped by a small, dark, glandular cell. The length of each hair results from the fact that one or two cells of the stalk have elongated extremely. Some of these hairs may be pauci-seriate.

Ordinary hairs or bristles occur in many forms. Only the long, thin, forked bristles on the petiole of *P. hispida* are considered extraordinary for the genus.

Hypanthial emergences (HANSEN, 1977) are rare in *Phyllagathis*. The filiform emergences with lateral hairs along their whole length seen in *P. brevipedunculata*, *P. prostrata*, and *P. longicalcarata* can be classified with WURDACK's pterolepoid hairs (1986, Fig. 240, 241) and with those in various *Osbeckia* species (HANSEN, 1977; Fig. 2.1, 5, etc.). The emergences in *P. marumiaetricha* are similar but usually have only a terminal bristle, or when forked or slightly more branched, each branch ends in a bristle (Fig. 2, *F*). The emergences in *P. guillauminii* differ from those above in being short, stout and fleshy elevations of the hypanthium wall, each with but a single or a few hairs (Fig. 2, *H*). The hypanthial glands (tubercles) in *P. tuberculata*, its allies, and *P. sessilifolia* are unique. In the former the gland is constricted or cylindrical to barrel-shaped (WEBER, 1987); in the latter the thick stalk tapers into a narrow, spheroidal gland (Fig. 2, *G*).

Inflorescence. — The basic type of the genus is apparently a thyrses topped by a terminal flower and comprising several nodes with dichasial or monochasial (scorpioid) partial inflorescences emerging from the axils of tiny bracts. This type fits well into the general pattern found in the family (for a survey see WEBERLING, 1988). The thyrses is mostly spike-like in that the internodes of the partial inflorescences are very short. Depending on the number of flowers produced the partial inflorescences appear as small clusters (e.g., in *P. griffithii*) or tail-like scorpioid branches up to 3 cm long (in *P. stolonifera*). In the latter case the branches occur in whorls of four, due to an initial dichasial (and then only monochasial) branching.

Commonly the rachis is elongate with several to many nodes, and the thyrses is often markedly spike-like, but it may be short with only two or three nodes (e.g., in *P. paucinodis* ined.). A few Bornean species (e.g., *P. atroviolacea* ined.) may have two lateral spike-like axes at the base of the rachis as described for *Kerriothyrsus* (HANSEN, 1988b).

In the Bornean *P. gymnantha* and two or three additional species the peduncle has only a single node from which four distinct scorpioid branches radiate. The head-like inflorescence of *P. rotundifolia* and *P. praetermissa* is a much contracted thyrses with large bracts forming a kind of involucre and contracted partial inflorescences of various branching habit. The "compound umbel" found in *P. tuberculata* and *P. magnifica* is also a contracted thyrses. But here the partial inflorescences have a long peduncle and the flowers are strictly arranged in scorpioid cymes (WEBER, 1987). This inflorescence type is unique in the *Sonerileae* s.l. (i.e., including the *Oxysporeae*).

In the majority of the species the inflorescence appears as a simple umbel. There is clear indication that the umbel is a contracted form of the thyrses. By further reduction the inflorescences may become simple dichasia (in *P. driessenioides* and *P. truncata*) or even solitary flowers.

In various umbellate species (e.g., *P. tetrandra*, *P. tonkinensis*) a node sometimes occurs

somewhere on the peduncle that occasionally bears a lateral umbel. In the two species just mentioned the node lies slightly below the terminal umbel, and in *P. tonkinensis* there may also be a subbasal node with two long, opposite branches ending in an umbel. A small, ordinary thyrses occurs in the Vietnamese *P. subrotunda* and the Chinese *P. erecta* and *P. hainanensis*. In the Chinese *P. anisophylla* smaller seriatly arranged accessory inflorescences occur in the axils of the leaves subtending the main inflorescence (see also p. 412).

The inflorescence types described above fit well into the general pattern of inflorescences found in the family as surveyed by WEBERLING (1988).

Flower. — *Phyllagathis* almost exclusively has 4-merous flowers. The only known exceptions are *P. ternata* and a specimen of *P. ovalifolia* (Poilane 27076), both 3-merous, and *P. rotundifolia*, *P. scortechinii*, and *P. prostrata* in which 5-merous flowers have been observed among the 4-merous ones.

Phyllagathis has two whorls of usually 4 stamens, except *P. tetrandra* in which only the 4 episepalous stamens exist. The anthers of the two whorls are dimorphic in *P. cordata* and *P. tuberculata* and slightly so in *P. hispida*; in all other species they are isomorphic and either equal, or those of the episepalous whorl more or less distinctly smaller (Fig. 3, D-E, J; 4, I-K).

In *Phyllagathis* anthers the base of the connective roughly divides into a dorsal and two ventral parts. The dorsal part may be anything from a mere tubercle to a long spur (a true appendage). The ventral parts usually are strands adnate to the base of the anther sacs, free or shortly united in front of the filament, and often exceeding the sacs in two blunt tubercles. The strands may, however, become larger and lobe-like or, in *P. driessenioides* (Fig. 4, C), exceed the sacs in short filiform appendages. As a variant the connective may be prolonged below the anther (e.g., in *P. prostrata* (Fig. 3, H) and *P. guillauminii*) and lack ventral adnations. This lack occurs in several Malayan species. The dorsal tubercle or spur is lacking only *P. griffithii*, where the anthers in addition are peculiar in that the anther sacs are conspicuously prolonged basally with a strand of connective tissue along the whole length of the prolongation.

In a great many species of the *Melastomataceae* the anthers, when studied externally under a low magnification, appear as if composed of two parts, i.e., the light coloured thecae or anther sacs and the darker coloured connective. Very often the basal dorsal and (or) ventral appendages may be coloured still differently. Because of the general resemblance in colour and texture between the appendages and the connective, the appendages have here been treated as if originating from the connective. This is contrary to LEINFELLNER (1958), who suggests that the ventral appendages are sterile prolongations of the anther sacs and that only the dorsal appendages are of the same origin as the connective.

Apically, as in a great many species in the *Sonerileae*, the ovary carries a crown of lobes (Fig. 1, B, D-E, G). A lobe develops in each of the V-shaped depressions separating the four locules, like a dam across a valley. The lobes usually elongate and unite above the locules and enclose a 4-angled bowl-shaped space with the style inserted in the centre. Often the locules bulge upwards and exceed the insertion of the style. In that case the base of the space is formed by the locules rather than by the ovary crown. The crown may also be narrow and surround the style in a tubular way. Usually the crown is glabrous or only has an indumentum of minute hairs, especially on the edge; a conspicuous indumentum of long hairs is seen only in *P. longicalcarata* and *P. guillauminii*.

Phyllagathis belongs to the genera which have distinctly stalked placentas. Only in *P.*

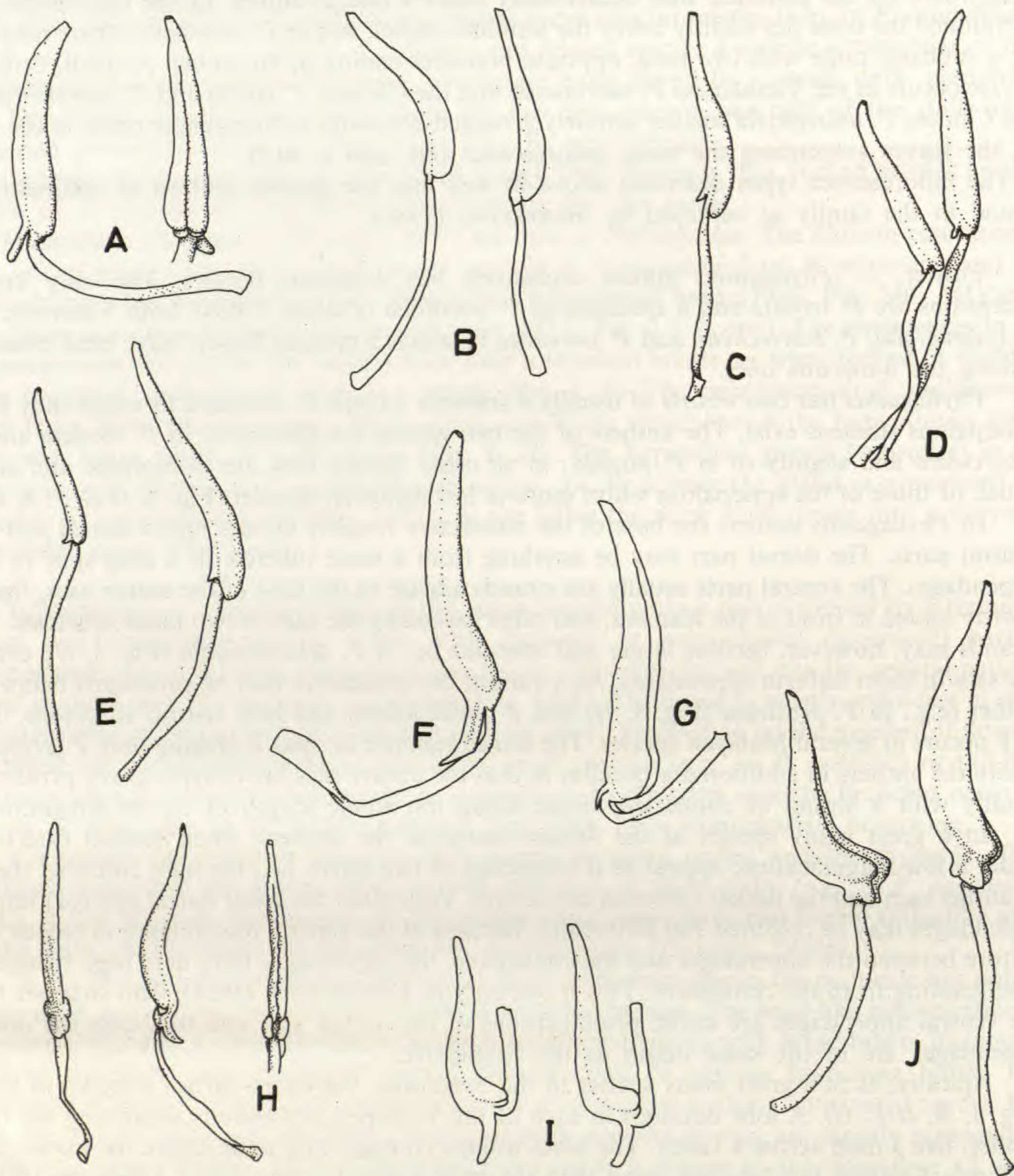


Fig. 3. — *Phyllagathis*, stamens, ca. $\times 5$: A, *P. tetrandra*, lateral and ventral view (Henry 10539, K). — B, *P. tonkinensis*, lateral view (Balansa 3520, P). — C, *P. ovalifolia*, lateral view (Henry 11035, K). — D, *P. cavaleriei*, epipetalous and episepalous stamen in lateral view (Cavalerie 56, P). — E, *P. longipes*, epipetalous and episepalous stamen in lateral view (Wilson 3647, P). — F, *P. longicalcarata*, lateral view (Pételot 7099, P). — G, *P. setotheca*, stamen from bud, lateral view (Tsang 30043, E). — H, *P. prostrata*, episepalous stamen in dorsal and ventral view, epipetalous stamen (middle) in lateral view (Poilane 30047, P). — I, *P. brevipedunculata*, epipetalous and episepalous stamen from bud (Kerr 20919, P). — J, *P. sessilifolia*, epipetalous and episepalous stamen in lateral view (Poilane 28997, P).

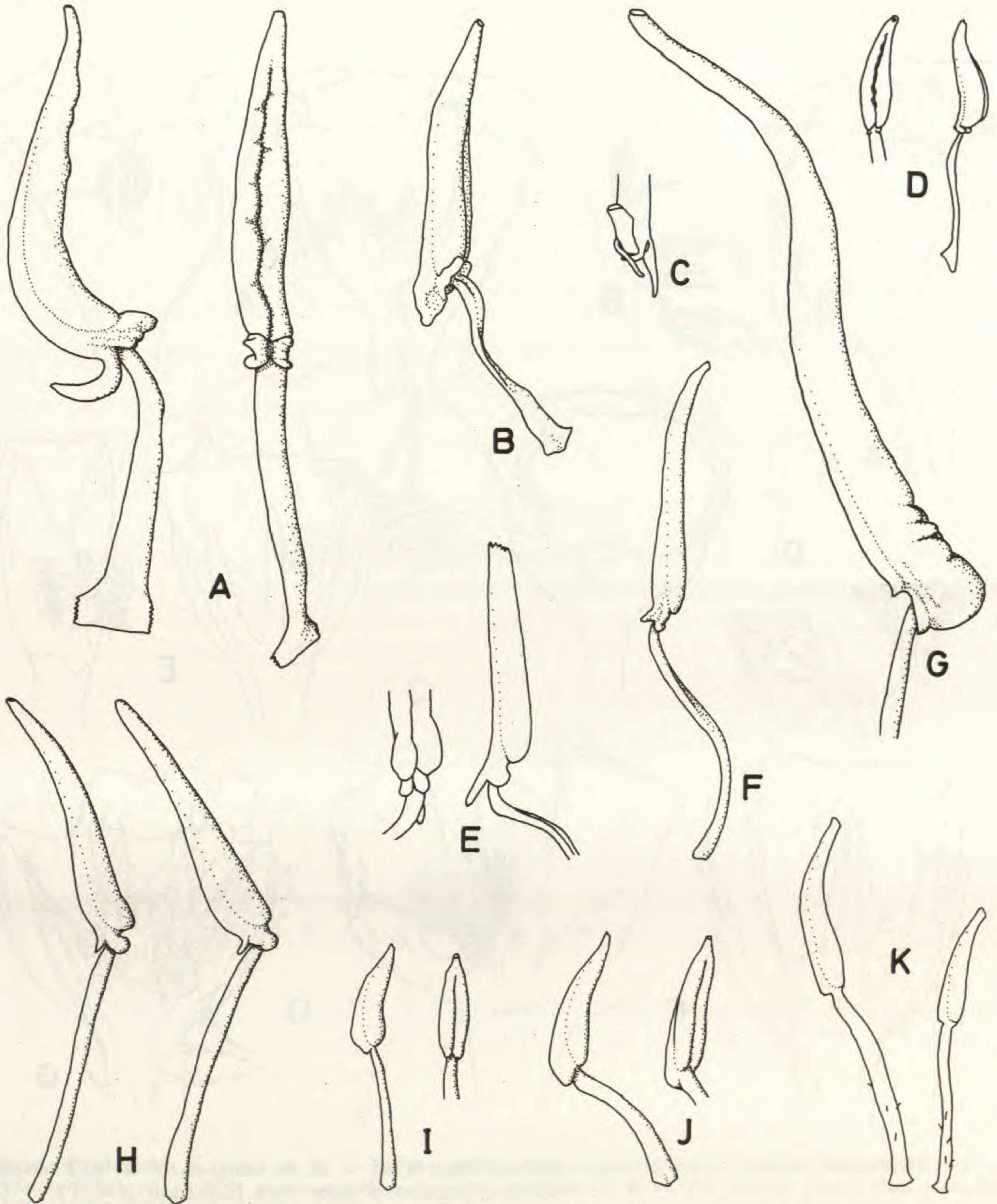


Fig. 4. — *Phyllagathis*, stamens, ca. $\times 5$: A, *P. truncata*, lateral and ventral view (*Poilane 6544*, P). — B, *P. megalocentra*, lateral view (*Poilane 3584*, P). — C, *P. driessenioides*, filament and basal part of anther with appendages, from bud (*Poilane 31799*, P). — D, *P. hainanensis*, ventral and lateral view (*How 72967*, A). — E, *P. guillauminii*, ventral and lateral view (*Pierre s.n.*, P). — F, *P. suberalata*, lateral view (*Poilane 29758*, P). — G, *P. marumiaetricha*, lateral view (*Eberhardt 3056*, P). — H, *P. melastomatoides*, epipetalous and episepalous stamen in lateral view (*How 72029*, A). — I, J, *P. tentaculifera*, epipetalous and episepalous stamen in lateral and ventral view (*Henry 10456*, K). — K, *P. fengii*, episepalous and epipetalous stamen (*Feng 11746*, A).

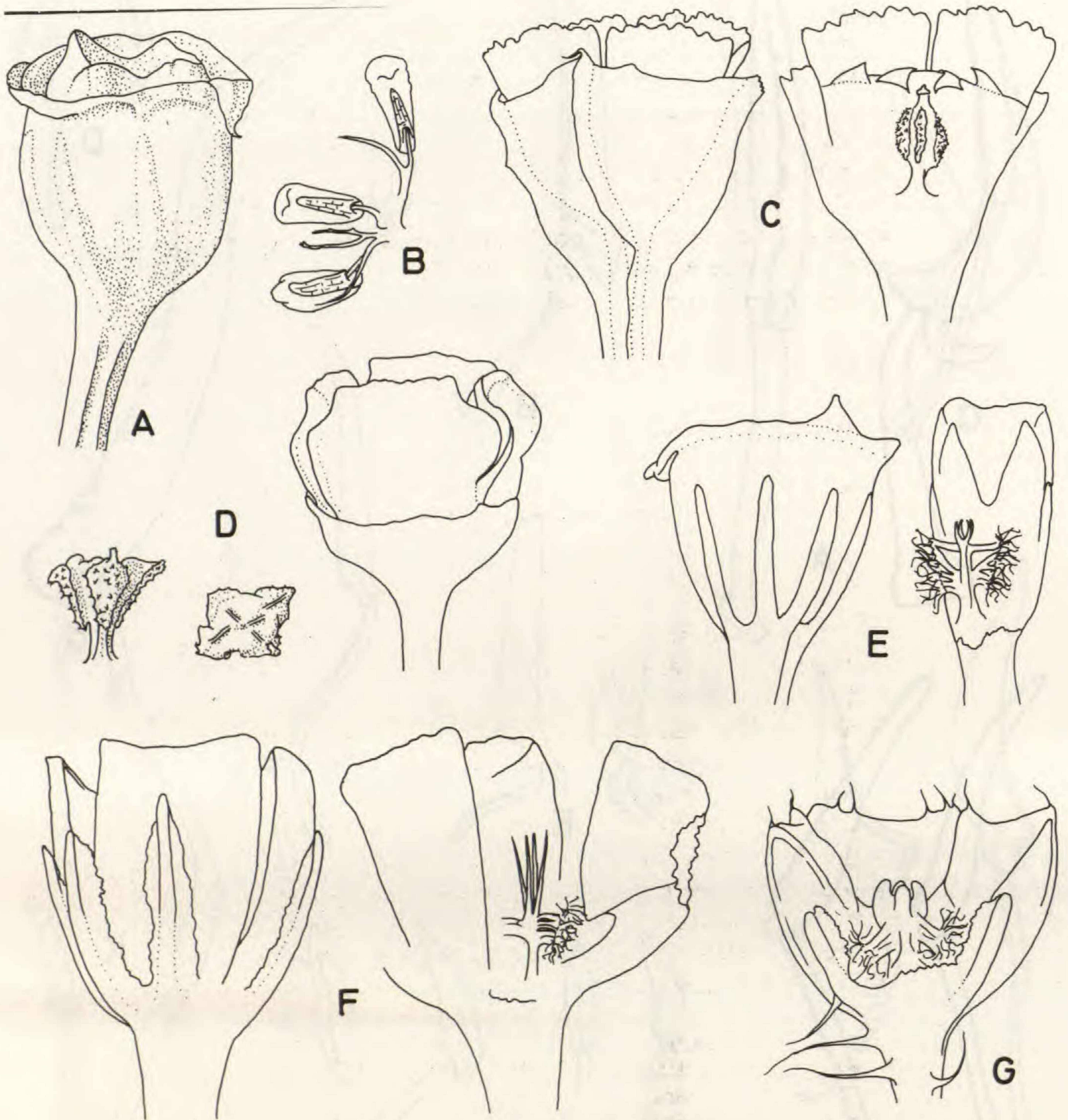


Fig. 5. — *Phyllagathis*, whole or parts of mature and old fruits, B, ca. $\times 20$, all others ca. $\times 5$: A, *P. setotheca*, mature fruit (Tsang 30349A, C). — B, *P. ovalifolia*, abscission of three seeds (Eberhardt 3676, P). — C, *P. subrotunda*, mature fruit from the outside and in longitudinal section (Tsang 29020, C). — D, *P. tonkinensis*, whole maturing fruit and central column removed from old fruit in lateral and apical view (Balansa 3520, P). — E, *P. stenophylla*, old fruit from the outside and longitudinally sectioned (Liang 63384, P). — F, *P. guillauminii*, old fruit from the outside and longitudinally sectioned (Pierre s.n., P). — G, *P. dichotoma*, old fruit, longitudinal section (Poilane 27081, P).

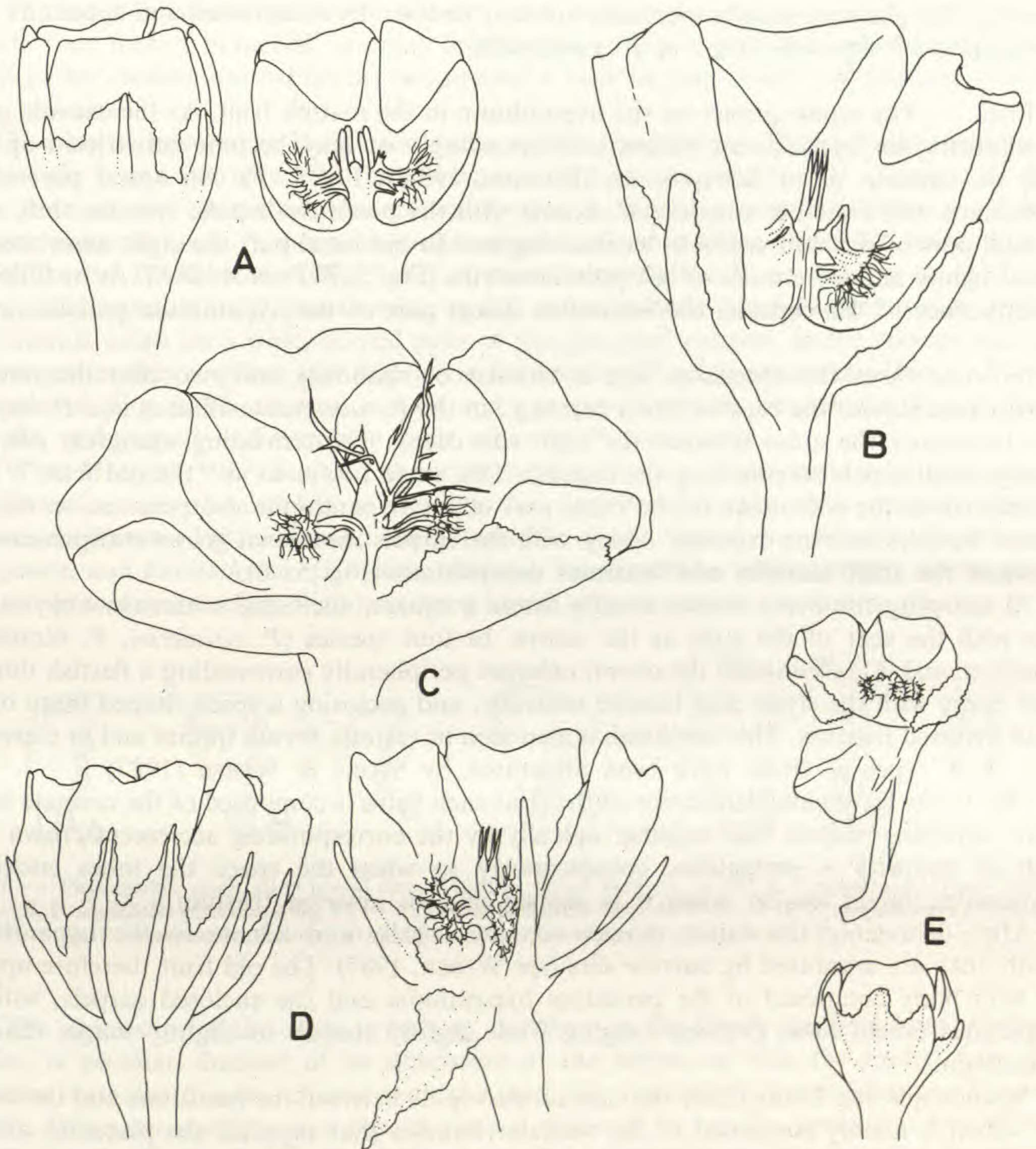


Fig. 6. — *Phyllagathis*, old fruits, ca. $\times 5$: **A**, *P. scorpiothyrsoides*, fruit from the outside and longitudinally sectioned (Tsang 26893, C). — **B**, *P. melastomatoides*, longitudinal section of fruit (Liang 64810, P). — **C**, *P. hainanensis*, longitudinal section of fruit (How 72967, A). — **D**, *P. setotheca*, fruit from the outside and longitudinally sectioned (Tsang 30349A, C). — **E**, *P. erecta*, inside and outside of fruit (Feng 13082, A).

tonkinensis and *P. subrotunda* are they sessile or subsessile. The placentas may be more or less vertically elongated, but the stalk, though often laterally compressed, usually has little vertical extension. The placenta usually is peltate, but may be laterally compressed and appear as a flat prolongation of the stalk (e.g., in *P. cavaleriei*).

Fruit. — The sepals persist on the hypanthium in the mature fruit. As the capsule grows into maturity the hypanthium widens correspondingly or may become constricted apically above the capsule, as in *Kerriothyrsus* (HANSEN, 1988b; Fig. 1, F). An apical part of the hypanthium wall (whether constricted or not) with the persistent sepals, remains thin, while the basal part of the wall swells to various degrees. In the basal part the eight main vascular bundles lignify and form more or less prominent ribs (Fig. 5, E-F; 6, A, D-E). At or following the dehiscence of the capsule, the unswollen apical part of the hypanthium perishes and is shed.

In some cases the abscission line is circular or shallowly wavy so that the remnant hypanthium encloses the capsule like a cup (e.g., in the *P. tuberculata*-alliance and *P. hispida*). More frequently the areas between the eight ribs decay. The remaining triangular rib parts strongly recall sepals surrounding the capsule. This stage I refer to as "the old fruit". In *P. marumiaetricha* the soft tissue of the basal part of the hypanthium also perishes, so that the vascular bundles become exposed. Along with the carpels the crown grows conspicuously in size when the fruit matures and becomes conspicuous (Fig. 5; 6).

At maturity the ovary crown usually forms a square, enclosing a narrow, obpyramidal space with the scar of the style at the centre. In four species (*P. cavaleriei*, *P. hispida*, *P. stolonifera*, and *P. subrotunda*) the crown enlarges peripherally surrounding a flattish thin top of the ovary with the styler scar located centrally, and enclosing a space shaped more or less like an inverted frustum. This condition is also seen in various *Bredia* species and in *Campimia wrayi*. Both types of fruits have been illustrated by STONE & WEBER (1987).

Due to the loculicidal dehiscence of the fruit each valve is composed of the connate halves of two adjoining carpels held together apically by the corresponding accrescent crown lobe, which at maturity is wedge-like, conspicuously so when the space the lobes enclose is obpyramidal, much less so when it is shaped like an inverted frustum.

After dehiscence the valves remain connate basally and adnate to the hypanthium; apically they are separated by narrow slits (see WEBER, 1987). The old fruit therefore appears as a firm body composed of the persistent hypanthium and the enclosed carpels, with the conspicuous crown lobes (valves) ranging from slightly shorter to slightly longer than the hypanthium.

Besides splitting loculicidally the capsule also splits between the partitions and the central axis, which is mainly composed of the vascular bundles that supplied the placentas and the style. The axis (placental column) persists inside the old fruit as a firm free column with the placentas radiating outwards (Fig. 5, C, E-G; 6).

In *Phyllagathis* the central column usually splits distally into the four vascular bundles which led to the style, so that the column becomes 4-horned (Fig. 5, E-G; 6, A-B, D-E). The splitting occurs either at the end of the beak of the placental column (HANSEN, 1982), or when there is no beak (which is the more common case) immediately above the placental stalks. Even though a horned placental column has been observed elsewhere in a few species of *Anerinleistus* (e.g., *A. quintuplinervis*), in *Cyphotheca*, in *Cyanandrium*, and in a specimen of

Bredia esquirolii, it is nevertheless one of the best characteristics distinguishing *Phyllagathis*. Among the 31 species in which old fruits could be studied, 22 had a horned placental column.

Phyllagathis hainanensis has a distinct beak with a rounded apex slightly below which radiate four forked branched vascular bundles the origin of which is uncertain (Fig. 6, C). *Phyllagathis cordata* has no horns, but instead 4 bulb-shaped bodies are present, one above each placenta.

The horns have some diagnostic value at the species level. The vascular bundles that become the horns alternate with the placentas, which is most clearly seen in unbeaked species (e.g., *P. cavaleriei*) when the horns are widely spaced. In such species the horns may look like long curved rods (as in *P. scorpiothyrsoides*, Fig. 6, A), or they may be short, blunt, stout and hump-like (in *P. dichotoma*, Fig. 5, G) or mere tubercles (in *P. erecta*, Fig. 6, E). Extreme among these species are *P. praetermissa* and *P. rotundifolia* in which the horns may appear as four minute cusps on a wide, domed apex of the placental column. In the species with horns close together they are long and acicular in for instance *P. melastomatoides* (Fig. 6, B) and *P. guillauminii* (Fig. 5, F), shorter, curved and tweezer-like in *P. stenophylla* (Fig. 5, E), and straight, rod-shaped and touching each other in *P. gymnantha*.

What HANSEN (1982) has said about the general likeness of the seeds in various genera of the *Sonerileae* s.l. also applies to *Phyllagathis*, and certainly the seeds recently illustrated (STONE & WEBER, 1987; WEBER, 1987) resemble those figured for *Blastus*, *Poillanammia*, *Campimia*, and *Kerriothyrsus* (HANSEN, 1982; pl. 3A, E; 1987a, 1988a, 1988b). So far only the seeds in *P. tonkinensis* (Fig. 7, E) have been found to be diagnostic for that species (see p. 379).

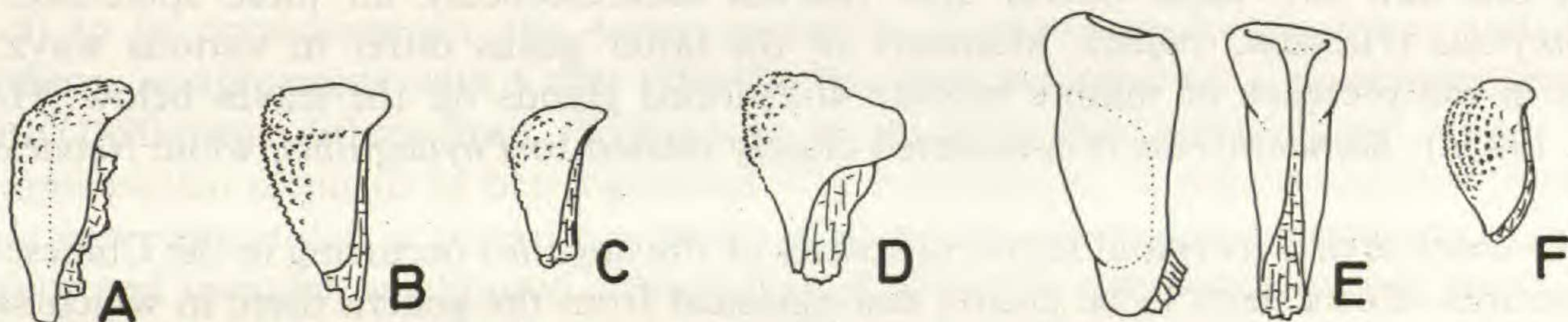


Fig. 7. — *Phyllagathis*, seeds, all in lateral view, E also in ventral view, ca. $\times 20$: A, *P. subrotunda* (Tsang 29020, C). — B, *P. sessilifolia* (Clemens 4186, P). — C, *P. ovalifolia* (Eberhardt 3676, P). — D, *P. megalocentra* (Poilane 3584, P). — E, *P. tonkinensis* (Balansa 3520, P). — F, *P. wenshanensis* (Feng 11186, P).

The abscission of the seeds, which as elsewhere in the family develop from anatropous ovules, is peculiar. Instead of an abscission at the hilum, so that the raphal part of the funicular vascular bundle remains with the seed, the separation occurs all along the raphal bundle. When eventually a seed breaks away it slides off its bundle, somewhat like when one pulls a sheath off a knife (Fig. 5, B). Because of the persistent vascular bundles the placentas look thready (Fig. 5, E-G; 6), another valuable characteristic for distinguishing *Phyllagathis*, which, however, is absent in the Bornean species with a scorpioid thyrses or pleiochasium and in several species elsewhere. These deviating placentas are rough as elsewhere in the *Sonerileae* (Fig. 5, C-D). Thready placentas are known also in *Cyphotheca*, *Driessenia hepaticoides* and *D. sessiliflora* (HANSEN, 1983, 1985b, 1989, 1990), and this character is at least approached in some specimens of *Anerinoleistus quintuplinervis*.

The old fruit is the last developmental stage. After that only an irregular decay of the fruit

takes place, starting with the softer tissues, which allows the observations of peculiarities of the vascularisation, e.g., in *P. rotundifolia*.

DELIMITATION

Recognition by inflorescence. The spike-like scorpioid thyrses are common in species of *Phyllagathis* in the Malayan and Bornean areas, but does not occur in the species in the Chinese-Indo-Chinese area. In the Malayan area this type of inflorescence is known in two other genera, distinctly in *Campimia wrayi* and indistinctly, because of very short and very densely scorpioid branches, in *Allomorpha bullata*. *Campimia wrayi* differs from *Phyllagathis* in the non-thready (rough) placentas and in the fruit (dehiscence and subsequent stages (HANSEN, 1988a), and *Allomorpha bullata* differs in the slightly compound inflorescence, each branch or partial inflorescence resembling a thyrses with scorpioid branches, and in the 3-merous flowers, sessile placentas, etc. The two species are not considered to be closely related to *Phyllagathis*.

In the Bornean area a scorpioid thyrses also occurs in species of *Borneothyrsus* (ined.) and *Neodriessenia*. Members of the former differ in their smaller yellow stamens (purplish in *Phyllagathis* in Borneo) and in having no ovary crown, or only a small and evanescent crown, and consequently a rounded capsule top. Besides, the inflorescence often has three axes, a central one and two basal lateral ones (partial inflorescences), all three spike-like, as in *Kerriothyrsus* (HANSEN, 1988b). Members of the latter genus differ in various ways, most readily in the presence of minute hyaline 4(-8)-lobed glands on the leaves below (HANSEN, 1985c, 1985d). *Borneothyrsus* is considered closely related to *Phyllagathis*, while *Neodriessenia* is not.

The absence of a scorpioid thyrses in species of *Phyllagathis* occurring in the Chinese-Indo-Chinese area allows them to be clearly distinguished from the genera there in which such an inflorescence occurs (*Allomorpha*, *Aschistanthera* (HANSEN, 1987b), *Kerriothyrsus* (HANSEN, 1988b), *Scorpiothyrsus*, and *Vietsenia* (HANSEN, 1984).

A scorpioid pleiochasium, known only in a few species of *Phyllagathis* in Borneo (e.g., *P. gymnantha*), occurs also in another Bornean genus, the monotypic *Brittenia*, which readily is distinguished by the 5-merous flowers, the succulence, the anther morphology, etc. (HANSEN, 1985a).

The simple umbel is the most wide-spread inflorescence in *Phyllagathis* and is found in all three areas; in the Malayan area in *P. hispida*, *P. scortechinii*, *P. stonei*, and specimens of *P. rotundifolia*; in the Bornean area in *P. elliptica*, *P. brookei*, and *P. rupicola*; and in the Chinese-Indo-Chinese area in many species, i.e., those which do not have flowers solitary or 2-3 together, or an ordinary thyrses.

The umbellate species in the Malayan area differ from members of other genera there in their scapose umbels. In the Bornean area umbels are known also in *Cyanandrium* (Sarawak) and *Enaulophyton* (Natuna Islands) both of which differ in their 5-merous flowers, and in a few *Anerinoleistus* species which differ in their ring of minute brown glands around the hair bases on the leaves above and their striate seed papillae. In the Chinese-Indo-Chinese area umbels occur in *Fordiophyton*, which differs in the highly dimorphic and unequal stamens and,

except from a few *Phyllagathis* species (see p. 356), in having raphides. Umbels also occur in specimens of *Plagiopetalum esquirolii* (for characteristics, see HANSEN, 1988c), and are common in *Bredia*. The separation of *Phyllagathis* and *Bredia* will be discussed below.

Species with flowers solitary or 2-3 together are *P. brookei* and *P. dispar* in the Bornean area, several in the Chinese-Indo-Chinese area, and *P. fruticosa* in the Malayan area. In Borneo *P. dispar* is the only species in the *Sonerileae* known exclusively to have solitary flowers. In the Chinese-Indo-Chinese area solitary flowers are found also in *Allomorpha parvifolia*, which differs from *Phyllagathis* species in the minute hyaline glands on the lower leaf surface (HANSEN, 1985d) and, except for *P. tonkinensis* and *P. subrotunda*, in the sessile placentas.

DISTINCTION FROM CLOSELY RELATED GENERA

Phyllagathis seems to be most closely related to *Borneothyrsus*, *Bredia*, *Brittenia*, *Cyanandrium*, *Cyphotheca*, *Enaulophyton*, *Sonerila*, *Stapfiophyton*, and *Tigridiopalma*.

Brittenia, *Cyanandrium*, *Enaulophyton*, and *Tigridiopalma* are readily distinguished from *Phyllagathis* by their 5-merous flowers. *Sonerila* has many features in common with *Phyllagathis*, e.g., scorpioid inflorescence branches, and fruits with an obpyramidal or inverted frustum-shaped depression, but is easily distinguished by the 3-merous flowers.

Left to be considered are the 4-merous genera *Cyphotheca*, *Stapfiophyton* and *Bredia*. *Cyphotheca*, in agreement with CHEN (1984b), has been accepted as a monotypic genus by HANSEN (1990) and differs from *Phyllagathis* as given in that publication.

Stapfiophyton seems to be heterogeneous. The type species, *S. peperomiifolium* (basionym *Sonerila peperomiaefolia*) is similar to species of *Fordiophyton* in having raphides and in the dimorphic and unequal, smallpored anthers (Fig. 8, H); it is transferred to that genus below, and *Stapfiophyton* consequently becomes a synonym of *Fordiophyton*. As to the other species previously placed in *Stapfiophyton*, I agree with CHEN (1984b) that *S. erectum* and *S. tetrandrum* (basionym *Phyllagathis tetrandra*) belong in *Phyllagathis*. No material was available of *S. breviscapum* and *S. degeneratum* for the present study, and their placement could not be decided. The classification of *S. elattandrum* (basionym *Phyllagathis elattandra*) is dealt with later in this paper.

Bredia comprises about 20 species, all Chinese, except *B. violacea* (Tonkin). CHEN (1984b) accepts 14 species. The separation of this genus and *Phyllagathis* is controversial, and cannot be done without allowing some overlapping of important characteristics. The umbellate *Bredia* are especially difficult to distinguish from *Phyllagathis*.

An examination of the *Bredia* species given in Table 1 shows that none of the characters studied is common to all species and that the genus can roughly be divided into four groups on the basis of a few characters (in indumentum, inflorescence, anthers, and old fruit). The inflorescence is usually an ordinary thyrses or an umbel. There is a tendency, however, in the umbellate species for a pair of accessory umbellate branches to develop below the main umbel so that a slightly compound inflorescence occurs.

Two types of androecium occur. In one the anthers of the two whorls are isomorphic and

equal; they may be said to be phyllagathoid (Fig. 8, *B, D, F*). In the other type they are dimorphic and unequal, and only the smaller ones are phyllagathoid. The larger anthers often are long and narrow and the connective is narrowly extended below the anther in a low dorsal and two low ventral ridges, as if decurrent on the filament. Such anthers are otherwise known in *Bredia*, and may be said to be bredioid (Fig. 8, *A, C, E, G*).

An ovary crown is usually present in species of *Bredia*. In the old fruit this structure commonly has enlarged and surrounds an inverted frustum-shaped depression, but it may be evanescent and persist as an indistinct edge peripherally on a rounded (or 4-humped) capsule top. The latter type of fruit is not known in *Phyllagathis*; the former only in *P. hispida*, *P. stolonifera*, *P. cavaleriei*, and *P. subrotunda*.

After the dehiscence of the fruit in *Bredia* species the whole of the hypanthium persists and swells, and ribs are generally not seen. In the old fruit the placentas are non-thready, and an approach to a 4-horned beak of the placental column has been observed only in some specimens of *B. esquirolii*.

The species of *Bredia* in groups 3 and 4 (Table 1) can be distinguished from *Phyllagathis* by their bredioid anthers, their ordinarily thyrsoid inflorescence, non-thready placentas and entire beak of the placental column. The evanescent crown is an additional character distinguishing group 3.

TABLE 1 : *Bredia*, distribution of various characters in a number of species (see text).

<i>Bredia</i>	inflorescence	anthers	top of capsule	crown	placenta	beak
1. <i>esquirolii</i> <i>fordii</i> 3 <i>velutina</i> 3 <i>gracilis</i> 3 <i>violacea</i>	umbel 1 umbel 1 umbel contracted thyrses compound dichasium	PPie PPie PPie PPiu PPie	inverted frustum inverted frustum inverted frustum	accrescent accrescent	non-thready non-thready	entire 2 entire
2. <i>cordata</i> 4 <i>microphylla</i> <i>tuberculata</i> <i>yunnanensis</i>	umbel 1-3-fl. clusters umbel 1 umbel 1	BPdu BPdu BPdu BPdu	inverted frustum inverted frustum	accrescent accrescent		
3. <i>amoena</i> <i>glabra</i> <i>quadrangularis</i> <i>sessilifolia</i>	thyrses thyrses thyrses thyrses	BPdu BP BPdu	4-humped 4-humped 4-humped 4-humped	evanescent evanescent evanescent evanescent	non-thready non-thready non-thready non-thready	entire entire entire entire
4. <i>hirsuta</i> <i>oldhamii</i> <i>scandens</i> 5	thyrses thyrses thyrses	BPdu BPdu BPdu	inverted frustum inverted frustum inverted frustum	accrescent accrescent	non-thready non-thready	entire entire

1 : if branched each branch ends in an umbel
2 : 4-horned beak also observed
3 : referred to *Phyllagathis* in CHEN (1984)
4 : regarded a variety of *B. esquirolii* in CHEN (1984)
5 : regarded a variety of *B. hirsuta* in CHEN (1984)

P : whorl of phyllagathoid anthers
B : whorl of bredioid anthers
i : anthers of the two whorls isomorphic
d : anthers of the two whorls dimorphic
e : anthers of the two whorls equal
u : anthers of the two whorls unequal

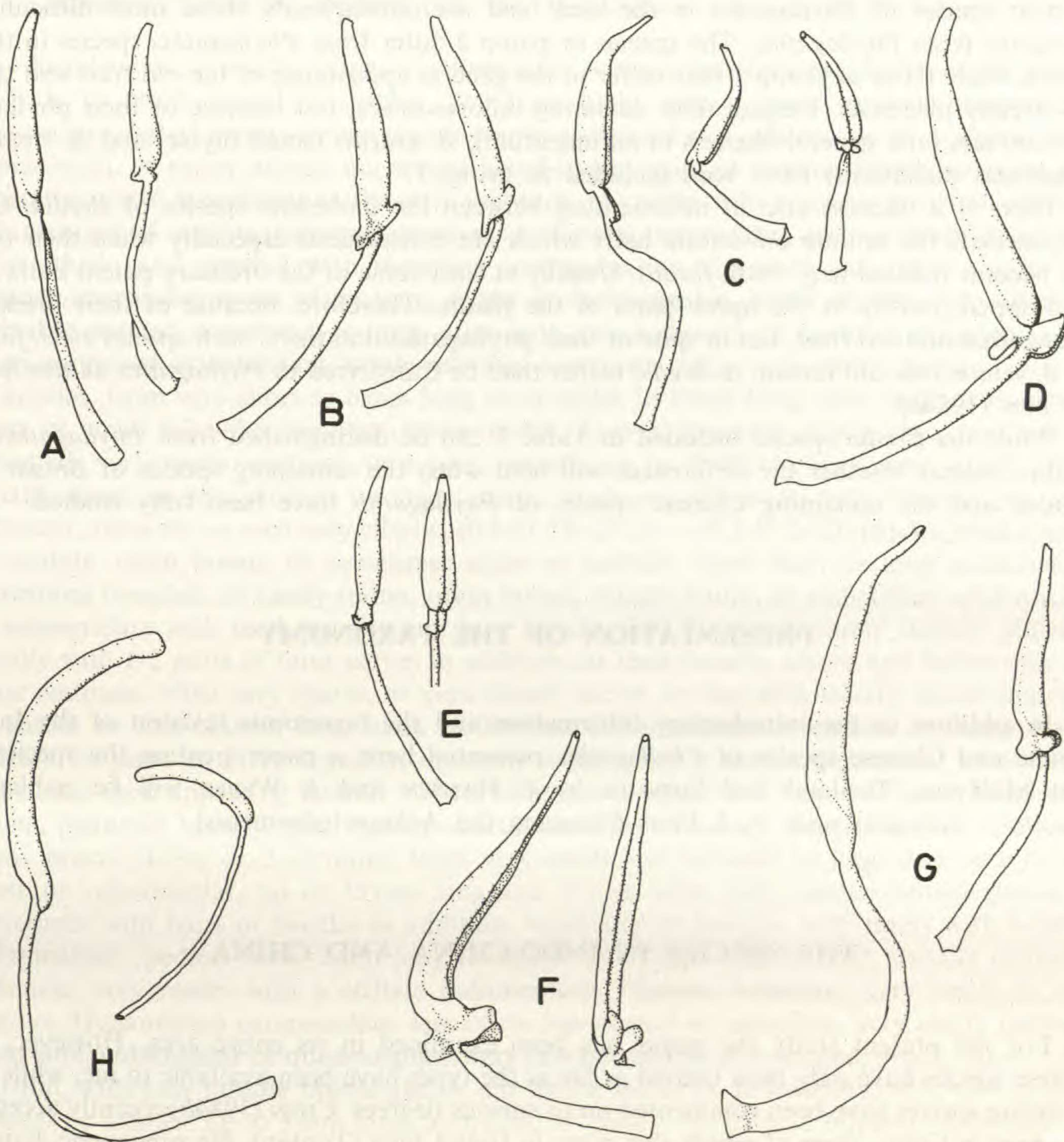


Fig. 8. — Stamens in *Bredia* and *Stapfiophyton*, ca. $\times 5$: A, *B. yunnanensis* (Lév.) Diels, episepalous bredioid and epipetalous phyllagathoid stamen (*Maire s.n.*, E). — B, *B. esquirolii* (Lév.) Lauener, episepalous and epipetalous stamen, both phyllagathoid (*Esquirol 3148*, P). — C, *B. oldhamii* J. D. Hook., episepalous bredioid and epipetalous phyllagathoid anthers (*Henry 2071*, K). — D, *B. velutina* Diels, epipetalous phyllagathoid stamen (*Henry 13479*, K). — E, *B. microphylla* Li, episepalous bredioid stamen (*Tsang 28432*, A). — F, *B. fordii* (Hance) Diels, episepalous bredioid stamens (*Ford s.n.*, K). — G, *B. tuberculata* (Guill.) Diels, episepalous bredioid and epipetalous phyllagathoid stamen (*Ducloux 2192*, P). — H, *S. peperomiifolia* (Oliv.) Li, episepalous and epipetalous stamen (*Ford 336*, K).

The *Bredia* species in group 1 and 2 (Table 1) have a basically umbellate inflorescence, as do most species of *Phyllagathis* in the area, and are consequently those most difficult to distinguish from *Phyllagathis*. The species in group 2 differ from *Phyllagathis* species in their anthers, while those in group 1 may differ in the general appearance of the old fruit and their non-thready placentas. Despite their deviating inflorescences, but because of their phyllagathoid anthers (and general likeness in indumentum), *B. gracilis* (small thyse) and *B. violacea* (compound dichasium) have been included in group 1.

There is a likeness also in indumentum between the umbellate species of *Bredia*. One component is the minute uni-seriate hairs which are conspicuous especially when their cells have become inflated (e.g., in *B. fordii*). Usually at least some of the ordinary patent hairs are gland-tipped, mostly in the upper parts of the plants. Therefore, because of their bredioid indumentum and old fruit, but in spite of their phyllagathoid anthers, such species as *B. fordii* and *B. velutina* should remain in *Bredia* rather than be transferred to *Phyllagathis* as was done by CHEN (1984a).

While the *Bredia* species included in Table 1 can be distinguished from *Phyllagathis*, it remains unclear whether the differences will hold when the remaining species of *Bredia* are included and the remaining Chinese species of *Phyllagathis* have been fully studied.

PRESENTATION OF THE TAXONOMY

In addition to the introductory information and the taxonomic revision of the Indo-Chinese and Chinese species of *Phyllagathis* presented here, a paper treating the species in West Malaysia, Thailand and Sumatra by C. HANSEN and A. WEBER will be published separately. [See also note by I. FRIIS following the Acknowledgements].

THE SPECIES IN INDO-CHINA AND CHINA

For the present study the genus has been examined in its entire area. However, the Chinese species have only been treated as far as the types have been available to me, while the remaining species have been commented on to various degrees. CHEN (1984b) recently accepted 28 species in China, three of which also occur in Indo-China (Tonkin). No subgeneric division of the genus seems relevant.

All lectotypes indicated in this paper have been selected here for the first time.

PHYLLAGATHIS Blume

Bijdr. Natuurk. Wetensch. 6 : 248 (1831).

— *Phyllagathis* sect. *Phyllagathis* ser. *Terminales* C. CHEN, Bull. Bot. Research 4 : 43 (1984), p.p.
Type species : *Phyllagathis rotundifolia* (JACK) BLUME.

— *Phyllagathis* sect. *Phyllagathis* ser. *Longiscapae* C. CHEN, Bull. Bot. Research 4 : 54 (1984). Type species : *Phyllagathis cavaleriei* (LÉV. & VAN.) GUILL.

Acaulescent or usually caulescent sometimes more or less prostrate herbs, to 90 cm high, or little to much branched shrubs, 20-350 cm high, with a basic vestiture (except in *P. marumiaetrica*) of minute brown glands (rarely elongated and inflated, see *P. ovalifolia* and *P. hainanensis*), or rarely minute uni-seriate gland-tipped hairs of various density on some or all vegetative parts, sometimes as the only vestiture, but often with a sparse to dense additional indumentum of various trichomes on some or all parts (see various parts of description). Stem short, thick, and gnarled with indistinct internodes, or elongated and more slender with distinct internodes up to 14 cm long, terete or 4(-6)-angular, rarely slightly flat, sulcate, or ribbed to winged, sometimes rooting, often with an additional indumentum of patent, or less often appressed or ascending, rarely retrorse, sometimes curly, very rarely gland-tipped hairs or bristles, from very short to 6 mm long or at nodes to 8 mm long, very rarely with elevated spots or small lobe-like swellings below nodes. Leaves opposite, isomorphic, and equal to subequal, very rarely unequal, in a pair; petiole up to 8(-20) cm long, very rarely absent, usually more or less clothed as stem; blade ovate or elliptic to very broadly so, rarely orbicular, obovate, or narrowly elliptic, (0.8-)3-18(-21.5) × (0.2-)1.2-12(-16) cm; base rounded to cordate, often broad, or sometimes acute or cuneate, apex short or long acuminate, or sometimes rounded, or rarely retuse, often broad, margin entire, or sometimes subdentate or subserrulate with teeth terminating in a bristle; 3-5(-7)-nerved, rarely slightly plinerved, usually with 1-2 pairs of faint nerves in addition, at least basally, above and below only with basic vestiture, often very sparse, or even absent above, or also with usually sparse appressed to patent to 2.5(-11) mm long hairs or bristles. Inflorescence an umbel, or rarely flowers solitary, in pairs or three together, or rarely a thyse or a simple dichasium, terminal, but sometimes soon appearing lateral, 1-20 cm long, many between 2-4 cm and many between 13-18 cm; peduncle usually only slightly shorter than inflorescence, usually with a vestiture as stem; bracts absent or 2 or more, from very small and subulate to large and very broadly ovate or suborbicular, up to 35 mm long and 20 mm wide, with minute brown glands and sometimes with hairs or bristles in addition, especially on margin, very rarely with a stellate indumentum; pedicel from 2 mm long in flower to 35 mm long in fruit, usually clothed as peduncle, very rarely with a stellate indumentum. Flowers 4-merous, very rarely 3- or 5-merous. Hypanthium campanulate, less often cup-shaped or urceolate, very rarely turbinate, often subquadrangular or quadrangular, very rarely 4-ribbed or 4-winged, 3-6.5(-10) × 1.5-5(-7.5) mm, with only minute brown glands uni-seriate hairs, or, in addition, with various kinds of hairs or bristles, up to 3 mm long, appressed or patent, rarely gland-tipped, bulbous-based, or stellate, or, in addition, sometimes with emergences. Sepals narrow to broad, attenuate, triangular or ligulate, or very rarely suborbicular or forming a truncate to subtruncate rim, often keeled, rarely winged, 0.5-3.5(-10) mm long, connate for 0.1-0.4 mm, usually with an indumentum as on the hypanthium, but more sparse, persistent in mature fruit. Petals elliptic, ovate to very broadly ovate or obovate, or suborbicular, often asymmetrical, (4-)7-11(-25) × 2.8-8(-14.5) mm, sometimes ciliate with gland-tipped hairs, red, pink, or purple, rarely white. Stamens 8, very rarely 4, 6, or 10, isomorphic, equal or unequal; filaments often flat, 4-8(-18) mm long when equal, or episealous ones (3.9-)5.1-7(-12.5) mm long and epipetalous ones 3.5-5(-8.5) mm long when unequal, glabrous or rarely with sparse minute uniseriate glandular

hairs; anthers narrowly ovate in lateral view, tapering, usually curved forward or backward, 3-9(-20) mm long when equal, or episepalous ones 5-7.5(-11) mm long and epipetalous ones 2.7-5.5(-8) mm long when unequal, colour uncertain (but purple stated once and yellow four times) connective distinct, very rarely prolonged below anther sacs, dorsally usually with a small spur, rarely a mere tubercle, or an up to 2 mm long pendent or backward curved spur, ventrally inappendiculate, or with two auricles or lobes, or very rarely to 1.5 mm long filiform appendages, usually adnate to base of anther sacs and exceeding them only when long, connective rarely with a basal collar clasping filament, anther sacs adnate to connective to their very bases, or a basal part free and with or without a strand of connective tissue on their back; pore one, usually more or less ventrally inclined and about as wide as apex. Ovary 4-locular, very rarely 3- or 5-locular, usually about half as long as hypanthium (crown excluded) and from two thirds to as long as hypanthium (crown included), partially adnate to it usually for one half to the whole of the length, anther pockets from half-way to all the way to base, very rarely shallow, usually to the same depth, but sometimes the alternate ones of different depths; ovary crown large, wide or narrow, lobes from partly to fully connate, their edge entire or sometimes more or less dentate, glabrous or with minute often uni-seriate glandular hairs, very rarely with a more conspicuous indumentum; placentas axile, protruding into locules on stalks, peltate or very rarely laterally compressed, or very rarely sessile. Style (6-)10-17(-23) mm long, glabrous or sometimes with minute uni-seriate glandular hairs on basal half, stigma small, rarely subcapitulate. Fruit a capsule; mature fruit campanulate, cup-shaped or urceolate, often quadrangular, often 8-ribbed, very rarely 4-winged, (3-)4.5-6.5(-12) × (3-)4.5-5(-9) mm, composed of the persistent hypanthium and sepalous rim and the carpels, ovary crown much enlarged, flushing hypanthium or, rarely, protruding up to 2 mm, old fruit campanulate or cup-shaped, often quadrangular, often 8-ribbed, (3-)4-8(-11) × (3-)4-8 mm, composed of the persistent basal part of the hypanthium and the carpels, basal part of hypanthium usually swollen (together with part of or the entire pedicel), often with eight rounded ribs ending distally in the exposed tips of the vascular bundles, crown lobes (valves) much enlarged, wedge-like, exceeding hypanthium by 0.6-4 mm, surrounding an obpyramidal or, very rarely, an inverted frustum-shaped space, placental (central) column unbeaked or rarely with an up to 0.5 mm long beak, usually 4-horned, horns mere tubercles or up to 2 mm long, close together or widely spaced basally, thick blunt and rod-shaped or more often slender tapering and pointed, curved inwards or sometimes outwards, placentas thready or, very rarely, non-thready. Seeds obovate, or less often cuneate or oblong, sometimes angular, 0.5-0.9(-1.2) mm long, usually beaked, testa usually slightly to distinctly tuberculate, brown or sometimes light brown, beak usually short and blunt, coloured as testa or lighter, strophiole brown or dark brown.

KEY TO THE SPECIES IN CHINA AND INDO-CHINA

1. Raphides present 2
- 1'. Raphides absent 3
2. Uni(-pauci)-seriate long hyaline hairs, composed of 1(-few) inflated cells and a terminal dark glandular cell, present at least on younger vegetative parts and on hypanthium and sepals in

- addition to other kinds of hairs; connective not prolonged below anther sacs, with a dorsal tubercle or spur 8. *P. ovalifolia*
- 2'. Uni(-pauci)-seriate hairs as described not present in addition to other indumentum; connective prolonged for ca. 1 mm below anther sacs, and with a dorsal spur and two ventral auricles. 16. *P. guillauminii*
3. Inflorescence a thyse 4
- 3'. Inflorescence an umbel, or flowers solitary or 2-3 together 7
4. Subcaulescent herb with more or less orbicular leaf blades; top of capsule with an inverted frustum-shaped depression 3. *P. subrotunda*
- 4'. Caulescent shrub with elliptic to ovate leaf blades; top of capsule with an obpyramidal depression 5
5. Stem ending in 3-5 inflorescences in a seriate arrangement, at least middle one a thyse with much contracted branches 23. *P. anisophylla*
- 5'. Stem ending in a single thyse 6
6. Distal stem and inflorescence branches with dense inflated whitish uni-seriate gland-tipped hairs and some patent 0.5 mm long hairs tipped with a narrow purplish gland. 22. *P. hainanensis*
- 6'. Distal stem and inflorescence branches with minute brown glands 21. *P. erecta*
7. Terminal leaf pair subtending 3-5 inflorescences in a seriate arrangement, each ending in a more or less umbel-like cluster of flowers 23. *P. anisophylla*
- 7'. Terminal leaf pair subtending an umbel or 1-3 flowers 8
8. Petiole with retrorse hairs at least below 9
- 8'. Petiole without retrorse hairs 11
9. Petiole with retrorse hairs below, and with patent 3-7 mm long bristles above; inflorescence subsessile 9. *P. brevipedunculata*
- 9'. Petiole with retrorse hairs both above and below; inflorescence usually long-pedunculate. 10
10. Subcaulescent plant with no distinct internodes and leaves crowded; hypanthium about as wide as long 2. *P. tonkinensis*
- 10'. Caulescent plant with internodes 2 cm long or more; hypanthium 2-3 times as long as wide. 4. *P. cavaleriei*
11. Leaves sessile or petiole 1-5(-12) mm long; plant glabrescent 12
- 11'. Leaves distinctly petiolate; plant glabrescent or hairy 14
12. Leaf base wide, cordate; internodes compressed; flowers in an umbel ... 12. *P. sessilifolia*
- 12'. Leaf base narrow, cuneate to acuminate; internodes 4(-6)-angular; flowers solitary or 2-3 together 13
13. Leaves unequal in a pair; wings of slightly old stem corky; pedicel in fruit at most 6 mm long; sepals narrow, twice as long as hypanthium 15. *P. suberalata*
- 13'. Leaves equal or subequal in a pair; wings of older stem not corky; pedicel in fruit at least 10 mm long; sepals not known 18. *P. stenophylla*
14. Leaf blade usually very broadly ovate to elliptic to orbicular, base usually very broad, rounded or cordate, apex usually very broad, acute, rounded, retuse or, rarely, bluntly acuminate, margin usually convex from base to apex 15
- 14'. Leaf blade usually narrow, i.e., twice as long as broad or longer, base narrow or broad, apex narrow or, rarely, broad, distinctly acuminate, margin concave apically 23
15. Inflorescence a simple dichasium 27
- 15'. Inflorescence an umbel 16
16. Stem 4-6-angular and 4-6-ribbed, sulcate; leaf blade broadly rounded basally 7. *P. scorpiothyrsoides*
- 16'. Stem terete or at most 4-angular; leaf blade usually cordate basally 17
17. Hypanthium with emergences distally; prostrate small-leaved plant with rooting stem 10. *P. prostrata*

- 17'. Hypanthium without emergences, usually large-leaved plant; caulescent more or less prostrate plant, or acaulescent to subacaulescent plant 18
18. Stamens 4 1. *P. tetrandra*
- 18'. Stamens 8 19
19. Plant with no indumentum but minute brown glands; anthers with a large stout dorsal spur. 27. *P. megalocentra*
- 19'. Plant with ordinary hairs on some vegetative part; anthers different 20
20. Caulescent more or less prostrate plant 21
- 20'. Acaulescent to subacaulescent plant, or caulescent erect plant 22
21. Petiole with ordinary hairs 4. *P. cavaleriei*
- 21'. Petiole with minute brown glands or uni-seriate hairs 5. *P. longipes*
22. Sepalous rim with some intersepalous teeth; placentas thready 6. *P. wenshanensis*
- 22'. Sepalous rim without intersepalous teeth; placentas not thready 3. *P. subrotunda*
23. Bracts, pedicels and hypanthium with stellate hairs 26. *P. marumiaetricha*
- 23'. Bracts, pedicels and hypanthium with a non-stellate indumentum 24
24. Stem with only minute brown glands or minute uniseriate hairs 25
- 24'. Stem also with ordinary hairs or bristles 28
25. Inflorescence an umbel 26
- 25'. Inflorescence a simple dichasium 27
26. Leaf base broadly cordate; plant prostrate 5. *P. longipes*
- 26'. Leaf base narrowly acute; plant erect 17. *P. setotheca*
27. Inflorescence subsessile 25. *P. driessenioides*
- 27'. Inflorescence long-pedunculate 24. *P. truncata*
28. Leaf base acute 13. *P. melastomatoides*
- 28'. Leaf base rounded to subcordate 29
29. Pedicel with patent bristles 30
- 29'. Pedicel with appressed bristles 31
30. Hypanthium with dense filiform hairy emergences; stem with dense much curly patent bristles 11. *P. longicalcarata*
- 30'. Hypanthium with long patent bristles; stem with slightly curly subappressed to ascending bristles and at nodes long patent bristles 14. *P. dichotoma*
31. Sepals linear, about twice as long as hypanthium; old stem at first with stubs of bristles, then smooth and grey 20. *P. tentaculifera*
- 31'. Sepals ligulate, about as long as hypanthium; old stem glabrescent, dark brown 19. *P. fengii*

1. *Phyllagathis tetrandra* Diels

Bot. Jahrb. Syst. 65 : 116 (1932). Type : *Henry 10539*, China, Yunnan, Mengtse (lecto-, K, photo C; isolecto-, E, NY, photo C).

— *Stapfiophyton tetrandrum* (DIELS) Li, J. Arnold Arbor. 25 : 29 (1944).

Subacaulescent herb, 20 cm high, slightly branched. Stem with nodes 1-3(-10) mm apart, subquadrangular, gnarled, rooting along most of its length, with sparse patent ca. 1 mm long hairs, and at nodes with bristles up to 3 mm long, all initially tipped with a small gland. Petiole 5-10 cm long, clothed as stem. Leaf blade broadly ovate, 6.5-7.8 × 3.7-6.2 cm; base broadly

cordate, apex rounded, margin entire; 3-5 nerved, above and below with very sparse gland-tipped hairs. Inflorescence umbellate, 14-20 cm long; peduncle 12-17 cm long, with minute brown glands, very sparse gland-tipped hairs, and at base of umbel some bristles up to 1.5 mm long; bracts 2, linear, ca. 2 mm long, reflexed, sparsely ciliate, subtending umbel, and several subulate smaller ones subtending pedicels; pedicel ca. 10 mm long, clothed as peduncle or with only minute brown glands. Hypanthium campanulate, quadrangular, 4-ribbed, ca. 4.5 × 2 mm, with minute brown glands and a few patent gland-tipped hairs. Sepals broadly triangular, keeled, ca. 1.5 mm long, connate for ca. 0.2 mm, clothed as hypanthium. Petals very broadly ovate, apiculate, ca. 7 × 5 mm, thin, reddish. Stamens 4, episealous; filaments flat, ca. 5.7 mm long; anthers narrowly ovate, slightly curving forward, ca. 5.7 mm long, connective keeled towards base of anther, dorsally produced into a conspicuous straight to slightly curved blunt pendant ca. 1 mm long spur, ventrally with two inconspicuous blunt tubercles adnate to anther sacs. Ovary about half as long as hypanthium (crown excluded) and about as long as hypanthium (crown included), adnate to it for half the length, anther pockets half-way to base; crown wide, lobes connate for half their length, edge bluntly distinctly dentate, with a few small uni-seriate glandular hairs; placentas protruding into locules on vertically much elongated ridge-like stalks. Style ca. 16 mm long. Fruit and seeds unknown. — Flowers in April. — Fig. 1, *B-C*; 3, *A*.

HABITAT : Old wood.

DISTRIBUTION : China (Yunnan). — Fig. 10, *B*.

SPECIMENS : *Henry 10539*, type (K, NY); *10539A* (E).

NOTES : The species can be recognized by having only four stamens. It seems not to be closely related to any of the other species.

In general appearance *Phyllagathis tetrandra* may be confused only with *P. tonkinensis*, *P. megalocentra* and *P. subrotunda*, but in the shape of the leaves the species resembles also *P. cavaleriei*, *P. wenshanensis*, *P. prostrata*, and *P. scorpiothyrsoides*. The leaves in these seven species are broad; apically, they are usually rounded, and basally they are cordate so that the margin of each side of a leaf is convex from base to apex, though there may be a slight concavity just below apex.

Phyllagathis prostrata differs from the mentioned species in having hypanthial emergences. Among the other species *P. tetrandra*, *P. tonkinensis*, *P. megalocentra* and *P. subrotunda* are (sub)acaulescent or have no distinguishable internodes, while *P. cavaleriei*, *P. wenshanensis* and *P. scorpiothyrsoides* are caulescent with distinct internodes.

In the first group *P. tonkinensis* and *P. subrotunda* differ from the other two species in their retrorsely hairy petioles, and *P. subrotunda* differs from the others in the thyrses. The anthers of *P. tonkinensis* are inappendiculate dorsally, while they are conspicuously spurred in *P. tetrandra* (tetrandrous) and *P. megalocentra* (octandrous).

In the group of caulescent species, *P. scorpiothyrsoides* is glabrous except for minute brown glands, while *P. cavaleriei* in addition has sparse to dense bristles at least on the stem, and *P. wenshanensis* dense uni-seriate ca. 1 mm long hairs on stem and petioles. See also *P. asarifolia* (p. 421).

2. *Phyllagathis tonkinensis* (Cogn.) Stapf

Ann. Bot. (London) 6 : 316 (1892).

Sonerila tonkinensis COGN. in A. & C. DC., Monogr. Phan. 7 : 1184 (1891). Type : *Balansa* 3520, Tonkin, Mont Bavi (lecto-, G-Barb.-Boiss.; isolecto-, BR, G-DC not seen, K, P, photo C).

Subacaulescent herb, 20-25 cm high. Stem a few cm long with a few short lateral branches, and with nodes close together, thick, with patent thin ca. 1 mm long hairs and up to 4 mm long bristles, or only the latter. Petiole 4-13 cm long, with retrorse more or less appressed 1-2.5 mm long thin hairs. Leaf blade very broadly ovate or elliptic, 9-13.5 × 7-11 cm; base broadly cordate, notched, apex broadly rounded to very broadly slightly acuminate, margin entire to subdentate; 5-nerved, both surfaces with sparse up to 1.5 mm long hairs, subappressed above and patent below, or hairs absent below. Inflorescence an umbel, terminal on a single axis or on 1-2 subbasal additional axes, 11-17 cm long; peduncle when inflorescence unbranched 11-13 cm long, when branched ca. 0.5 cm long, branches 6.5-13 cm long, all clothed with minute brown glands; bracts absent or narrow, 2 mm long; pedicel from 4 mm long in flower to 11 mm long in fruit. Hypanthium widely campanulate, subquadrangular, ca. 3.5 × 4 mm, with minute brown glands, upper free part of wall thin, basal adnate part thick. Sepals widely triangular, ca. 1 mm high, connate for 0.1 mm, with a thick keel pointed into a short hair, clothed as hypanthium. Petals broadly ovate, acute, ca. 4.5 × 2.8 mm, thin, pinkish. Stamens 8, unequal (due to filaments); filaments flat, episealous ones ca. 6 mm long, epipetalous ones ca. 4.7 mm long; anthers narrowly ovate, tapering, curving slightly backwards, ca. 5 mm long, connective basally forming a latero-ventral auricle on each side of filament, otherwise inappendiculate. Ovary about three fourth the length of hypanthium (crown excluded) and as long as hypanthium (crown included), adnate to it for about one fourth the length, anther pockets to base of ovary; crown wide, lobes fully connate, with minute brown glands on the inside and the outside; placentas sessile, elongated, axile in upper two thirds of locules. Style ca. 13 mm long. Mature fruit campanulate, quadrangular, ca. 5.5 × 5.5 mm, with coriaceous veined accrescent valves exceeding the hypanthium by 1.5 mm, old fruit campanulate, subquadrangular, ca. 6 × 5.5 mm, with central axis widening from base of placentas upwards due to swelling, unbeaked, not horned, placentas not thready. Seeds ca. 1.2 mm long, elongated, widening upwards, with an inflated prolongation on top, also widening upwards and with a slight depression apically at one side connected with the raphal furrow, testa almost smooth, brown, prolongation light brown, strophiole inconspicuous, dark brown. — Flowers and fruits in June and July. — Fig. 1, *D-E*; 3, *B*; 5, *D*; 7, *E*.

HABITAT : On calcareous clay in humid forest, altitude unknown.

DISTRIBUTION : Vietnam (Tonkin). — Fig. 10, *C*.

SPECIMENS : *Balansa* 3520, type (BR, G, K, P); *Colani* s.n., herb. *Pételot* 3223 (P).

NOTES : The species is subacaulescent with short lateral shoots. Some distinctive characters for *Phyllagathis tonkinensis* are given in the notes under *P. tetrandra* (p. 377). Other useful characters for the identification of the species are the retrorse hairs on the petiole (seen

elsewhere only in *P. ovalifolia*, *P. subrotunda*, *P. brevipedunculata* and sometimes *P. cavaleriei*, the hypanthium as wide as long or wider and only shortly adnate to the ovary, the auriculate anther appendages, the sessile elongated placentas, the placental column in old fruits, and the seeds.

The placentas appear as a ridge in the upper two thirds of the axils of the locules. As typical in *Phyllagathis* they persist in the old dehisced fruit and form, together with the central vascular strands, a free column which in this species is peculiar in that it widens upwards due to swelling of the tissues and in that it does not have horns.

The seeds are characterized by their large inflated beak, slightly widening in continuation of the seed body (not at an angle to it) and with an apical depression, which at one side passes into the raphal furrow.

When unbranched the inflorescence is like the one seen in many species of *Phyllagathis*, i.e., an umbel borne on a long peduncle. When branched, opposite branches, each ending in an umbel, usually develop at a subbasal node on the peduncle. The minute brown glands on the inflorescence really are minute uni-seriate hairs bending in an L- or almost U-shape.

3. *Phyllagathis subrotunda* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 40 (1990). Type : *Tsang 29020*, Indo-China, Tonkin, Ha-coi, Taai Wong Mo Shan, near Chuk-phai (holo-, A, photo C; iso-, C, E, K, P).

Subcaulescent herb, 20 cm high. Stem thick, much gnarled from leaf scars, with sparse to 4 mm long brown bristles. Petiole 5-8 cm long, with more or less retrorse to 4 mm long thin bristles. Leaf blade very broadly ovate to elliptic to orbicular, 13-17 × 13-15 cm; base very broadly cordate, apex very broad, rounded or very slightly bluntly acuminate, margin entire, with very sparse 2-4 mm long thin bristles; 5-7-nerved, above and below with very sparse minute brown glands, below also with sparse 1 mm long hairs on nerves. Inflorescence thyrsoid, 15-18 cm long, few-flowered, with flowers ending 1 mm long branches, either only at a terminal node or also at one lower node, with sparse minute brown glands and a few 1 mm long hairs at nodes; peduncle 13 cm long; bracts linear, 1-2 mm long; pedicel 10 mm long in fruit. Flowers not known. Mature fruit 4-merous, cup-shaped, 4-winged, ca. 6 × 5 mm, sepalous rim subtruncate, lobes with an exceeding keel and a terminal hair, with the accrescent bluntly dentate ovary lobes surrounding an inverted frustum-shaped space and exceeding the sepalous rim by 1 mm, top of capsule inside crown very thin and splitting into eight triangular lobes at dehiscence, placental column unbeaked (at dehiscence), placentas with high laterally compressed ridges not thready (at dehiscence). Seeds oblong to obovate, ca. 1 mm long, with a stout blunt beak, raphal furrow wide, filled with a large brown strophiole, testa and beak light brown. — Fruits in May and June. — Fig. 5, C; 7, A; 9.

HABITAT : Dry sandy soil in thicket, altitude unknown.

DISTRIBUTION : Vietnam (Tonkin), known only from the type. — Fig. 10, D.

NOTES : *Phyllagathis subrotunda* may be recognized by the subcaulescence, by the retrorsely hairy petioles, by the more or less orbicular leaf blades, by the long-pedunculate

few-flowered thyrses, by the sessile placentas, and by the fruit with an inverted frustum-shaped apical depression.

The differences between *P. subrotunda* and other acaulescent species, as well as other species with very broad leaves, have been discussed under *P. tetrandra* (p. 377).

Phyllagathis subrotunda does not seem to be related to the other thyrsoid species *P. hainanensis* and *P. erecta*, nor to *P. cavaleriei*, the only other species in the area which has a fruit with an inverted frustum-shaped depression.

It shares sessile placentas with *P. tonkinensis*. They are non-thready in the available fruits but these may not be quite mature so that a natural abscission may not have occurred. The two species also share a columnar beak without horns at least at the young stage.

Phyllagathis subrotunda does not fit well into *Phyllagathis* nor into any other genus. When flowers and old fruits become known they may allow to resolve the affinities of the species.

Among CHEN's (1984) new Chinese species only *P. asarifolia* shows some resemblance to *P. subrotunda*, but differs in the glabrous stem, the much longer petioles, the prominent ovate sepals and the umbellate inflorescence (according to CHEN's protologue).

4. *Phyllagathis cavaleriei* (Lév. & Van.) Guillaumin

Notul. Syst. (Paris) 2 : 325 (1913).

Allomorpha cavaleriei LÉV. & VAN. in LÉV., Mém. Soc. Sci. Nat. Cherbourg 35 : 394 (1906). Types : *Cavalerie* 56, China, Kweichow, Juin-ou-chan (lecto-, P, photo, C; isolecto-, E, photo, C); *Cavalerie* 246, China, Kweichow, Pin-fa (syn-, E, photo C); *Cavalerie s.n.*, herb. *Bodinier* 2675, China, Kweichow, Tou-chan (syn-, E, photo C, P).

Phyllagathis tankahkeei MERR., Lingnan Sci. J. 7 : 316 (1931). Type : *Chung* 3596, China, Fukien, Yenping, Buong Kang (holo-, not traced; iso-, E).

— *Phyllagathis cavaleriei* (LÉV. & VAN.) GUILL. var. *tankahkeei* (MERR.) WU, Fl. Yunnanica 2 : 111 (1979).

Herb, 10-30 cm high. Stem subquadrangular, usually prostrate, rooting along most of its length, with sparse to dense more or less curly patent or retrorse 1-6 mm long thin or variously stout bristles (only *Ching* 5740 is glabrous except for minute brown glands). Petiole (0.6-)2-7.5(-13.5) cm, clothed as stem, but bristles to 7.5 mm long and sometimes only on upper side. Leaf blade ovate or more often broadly to very broadly ovate to orbicular, 4-14.5 × 3.2-12 cm; base broadly cordate, apex broad to very broad, usually rounded, less often acute, acuminate or subemarginate, margin entire, rarely subdentate or subserrulate; 5-7-nerved, upper surface clothed with sparse thin bristles usually long (up to 11 mm, but less than 0.5 mm ones also observed), sometimes restricted to a narrow zone along margin, or rudimentary only at margin, lower surface similarly clothed, but hairs usually shorter, often restricted to main nerves. Inflorescence an umbel, 4-18 cm long; peduncle 3-16 cm long, with sparse minute glands and sometimes in addition with few to many thin patent to retrorse hairs; bracts caducous, ovate, 6-14 mm long, with a few long hairs on outside or only at margin; pedicel 5-10 mm long in flower, up to 12 mm long in fruit. Hypanthium narrow, urceolate to campanulate, subquadrangular, 4-5.3 × ca. 1.5 mm, with minute brown glands and rarely a few short hairs. Sepals low and broadly triangular to rounded, 0.5(-1) mm high, connate for ca. 0.1 mm, with a low dorsal keel pointed close to apex, sometimes into a short hair. Petals

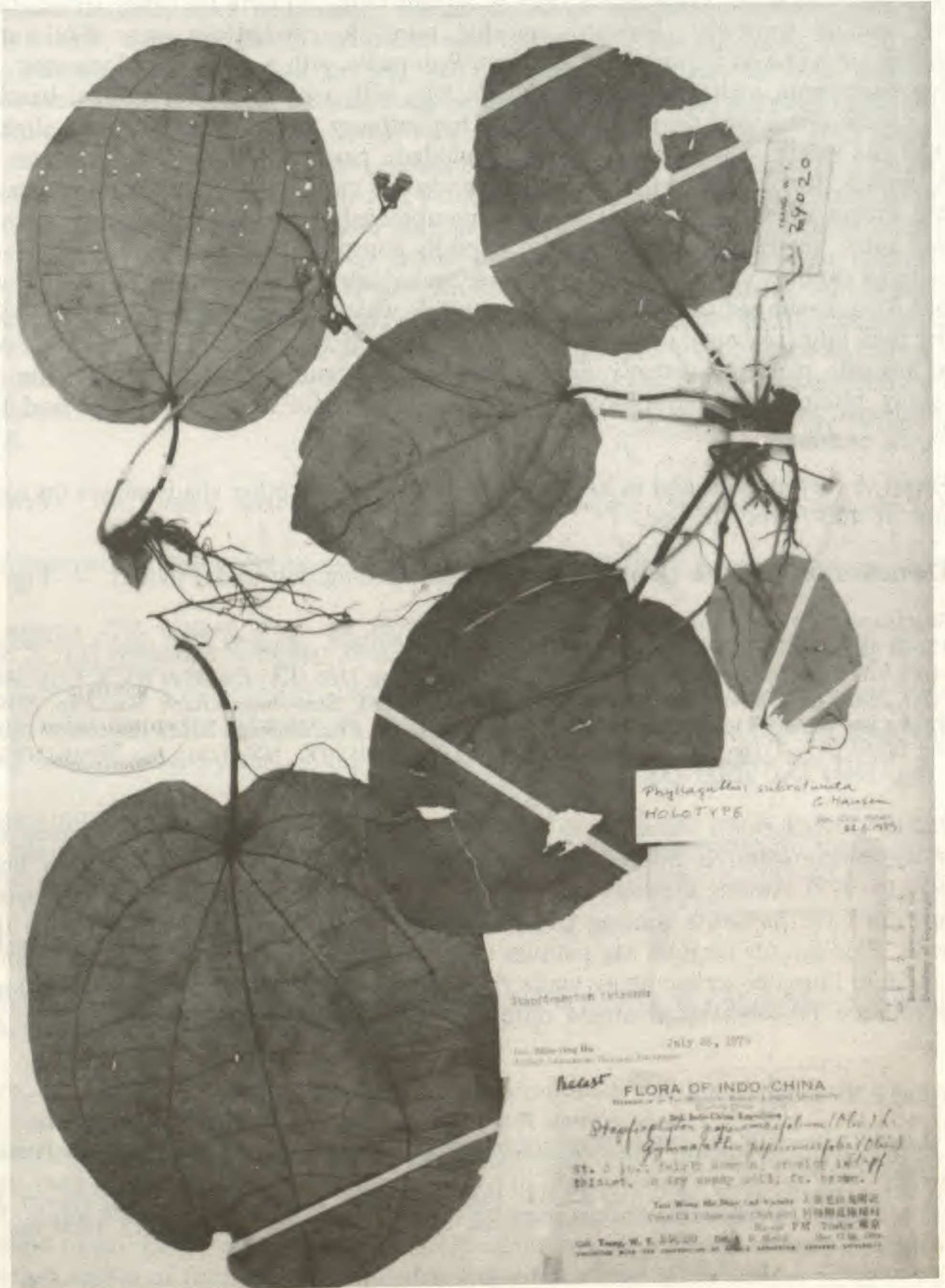


Fig. 9. — *Phyllagathis subrotunda*, holotype.

ovate, ca. 5.5 × 3 mm, thin, pink rarely white. Stamens 8, unequal; filaments flat, episealous ones (5.1-)6-7 mm long; epipetalous ones 4.2-6 mm long; anthers narrowly ovate, tapering, usually bending somewhat forward apically, purplish, episealous ones 5-6.1 mm long, epipetalous ones (3.5-)4.2-5 mm long, connective dorsally with a ca. 0.2 mm long spur, usually bending backwards, ventrally inappendiculate, but with a more or less distinct basal-dorsal strand. Ovary about one third the length of hypanthium (crown excluded) and slightly less than half the length of hypanthium (crown included), partially adnate to it for about half its length, anther pockets about half-way to base; crown narrow, lobes truncate to emarginate, connate except distally; placentas laterally compressed with ovules on edge and on two opposed sides, protruding into locules on laterally compressed short stalks. Style 11-15.5 cm long, stigma capitulate. Mature fruit urceolate, subquadrangular, 3-4.5 × 3.5-4 mm, with an inverted frustum-shaped apical depression, old fruit widely campanulate, (3-)4-5 × 3-5.5 mm, broader than long, placental column unbeaked, horns widely spaced, ca. 0.3 mm long, pointed, curved inwards, placentas thready. Seeds obovate, ca. 0.5 mm long, testa tuberculate, brown, beak short, blunt, brown, strophiole dark brown. — Peak of flowering in June and July. — Fig. 1, A; 3, D.

HABITAT : By streams and in humid places in forests and other shady places on rocks, silt or sand at 400-700 m altitude.

DISTRIBUTION : China (Kweichow, Kwangsi, Kwangtung and Fukien). — Fig. 10, E.

SPECIMENS : *Cavalerie* 56, type (E, P), 246, syntype (E), *s.n.*, herb. *Bodinier* 2675, syntype (E, P); *Ching* 5689 (A, NY, US); *H. H. Chung* 2862 (BM, E, K), 3596, type of *P. tankahkeei* (E); *Z. S. Chung* 81755 (A), 82001 (A); *Esquirol* 3245 (E, K, P), 5094 (P); *Fang* 3786 (K); *Lau* 4544 (G, S, US), 28427 (A), 28429 (A), 28430 (A), 28740 (A); *Mell* 637 (C); *Sin* 9941 (NY); *Sino-Amer. Guizh. Bot. Exp.* 2259 (BM); *Steward & Cheo* 933 (NY); *Swinhoe s.n.* (K); *Tsang* 22647 (A, P), 22660 (A, BM, P, S), 28317 (A); *Tsang & Wong* 14751 (A); *Tsiang* 5479 (M), 6388 (BM, E, P, S), 6389 (K, NY, US); *Tso* 20995 (NY); *Wang* 39150 (A), 39441 (A), 40033 (A).

NOTES : *Phyllagathis cavaleriei* is characterized by the broad roundish leaves and the prostrate rooting stem. It differs from other species with such leaves as given under *P. tetrandra* (p. 377). Among the caulescent species, besides *P. wenshanensis*, only *P. longipes* and *P. prostrata* have prostrate rooting stems. Both are more conspicuously prostrate than *P. cavaleriei*. *Phyllagathis longipes* has petioles usually 10-18 cm long and an indumentum partly of ca. 0.2 mm long uni-seriate hairs, while *P. cavaleriei* has petioles usually 2-7.5 cm long and no such hairs. *Phyllagathis prostrata* differs in the hypanthial emergences.

5. *Phyllagathis longipes* Li

J. Arnold Arbor. 25 : 31 (1944). Type : *Chiao* 1625, Sikang, Konting, Ta Kwan, Ta Hsiang Ling (holo-, A, photo C).

Phyllagathis cavaleriei (LÉV. & VAN.) GUILL. var. *wilsoniana* GUILL., Notul. Syst. (Paris) 2 : 325 (1913). Type : *Wilson* 3647, Western China, Sétchuen, entre Kiating et Ta tsien lou (holo-, P, photo C; iso-, A, K).

Herb, 25-30 cm high, with minute uni-seriate hairs on vegetative parts and on hypanthium and sepals, and additional hairs on the leaf blade. Stem prostrate, rooting, branching,

subquadrangular, to ca. 20 cm long. Petiole 10-18 cm long. Leaf blade broadly ovate, 6-10.5 × 4-7 cm; base cordate, apex acuminate, margin entire or subdenticulate to serrulate, teeth ending in a hair; 5-nerved, above and below with sparse ca. 1 mm long curly soft hairs, most sparsely below. Inflorescence an umbel, 14-17 cm long; peduncle 12-15 cm long; bracts unknown (scars only); pedicel 5-9 mm long in flower. Hypanthium narrowly campanulate, subquadrangular, ca. 4.5 × 2 mm. Sepals very short and widely triangular, ca. 0.5 mm high, connate for 0.2 mm, with a pointed keel. Petals broadly obovate, apiculate, ca. 7 × 5 mm, thin pinkish. Stamens 8, unequal; filaments flat, 4-5.8 mm long; anthers narrowly ovate, straight to slightly S-shaped, shorter ones 3-4.3 mm long, longer ones 6-7.3 mm long, base of anther sacs free and without strand of connective tissue, connective dorsally with a ca. 0.1 mm long tubercle, ventrally inappendiculate. Ovary about one third the length of the hypanthium (crown excluded) and about half the length of hypanthium (crown included), partially adnate to it for its whole length, 4 anther pockets to base of ovary and 4 very shallow; crown wide, lobes large, fully connate, denticulate apically; placentas unknown. Style 7-13 mm long, stigma subcapitate. Fruit unknown. — Flowers in July and August, young fruits in September. — Fig. 3, E.

HABITAT : In forests, near streams or on rocky slopes, 1300-2800 m altitude.

DISTRIBUTION : China (Yunnan, Szechuan). — Fig. 10, F.

SPECIMENS : *Chiao* 1625, type (A), 2047 (A); *Liu* 2241 (A); *Tsai* 51295 (A); *Wilson* 3647, type of *P. cavaleriei* var. *wilsoniana* (A, K, P).

NOTES : *Phyllagathis longipes* can be recognized by the prostrate rooting stem slightly ascending only distally, by the ca. 0.2 mm long uni-seriate hairs, and by the 10-18 cm long petioles.

CHEN (1984) accepted *P. cavaleriei* var. *wilsoniana* as a variety of *P. cavaleriei*, but the type of the variety agrees in every respect with *P. longipes* and certainly belongs there.

6. *Phyllagathis wenshanensis* S. Y. Hu

J. Arnold Arbor. 33 : 171 (1952). Type : *Feng* 11186, China, Yunnan, Wen-shan-hsien, Lao-jiun-shan (holo-, A, photo C).

Herb, ca. 12 cm high. Stem ca. 4 cm long, quadrangular, rooting, with dense uni-seriate curly to 1 mm long hairs and a few to 3 mm long soft hairs at nodes. Petiole 2.7-4.5 cm long, with uni-seriate hairs as stem and a few longer pluri-seriate hairs. Leaf blade orbicular, ca. 7.5 × 7.5 cm; base cordate, apex very broadly rounded to retuse, margin entire to subdenticulate; 5-nerved, upper surface with 0.7-1.5 mm long soft hairs and ca. 0.2 mm long appressed uni-seriate gland-tipped hairs, lower surface similarly clothed and in addition with an indumentum as petiole on nerves of first and second order. Inflorescence an umbel, 13 cm long; peduncle 11.5 cm long, clothed as stem, but less densely, with a few additional hairs at apex; bracts unknown; pedicel in fruit 12 mm long, clothed as peduncle but less densely. Flowers unknown.

Mature fruit campanulate, ca. 4.5×4 mm, sepals widely triangular alternating with one or two teeth in each sinus, valves thin and coriaceous slightly exceeding hypanthium and persistent sepalous rim, placentas thready. Seeds obovate, ca. 0.6 mm long, testa tuberculate, light brown, beak short and blunt, pale brown, strophiole brown. — Fruits in August. — Fig. 2, *D*; 7, *F*.

HABITAT : In mixed forest at 2300 m altitude.

DISTRIBUTION : China (Yunnan), known only from the type. — Fig. 10, *G*.

NOTES : *Phyllagathis wenshanensis* is a small herb which can be recognized by the orbicular leaves (see notes under *P. tetrandra*), the dense ca. 1 mm long curly uni-seriate hairs on stem and petioles, and the one or two intersepalous teeth in each sinus between the lobes. They seem to have developed from the margin of the sepalous rim and are different from intersepalous emergences that develop more distally from the upper margin of the hypanthium.

7. *Phyllagathis scorpiothyrsoides* C. Chen

Bull. Bot. Research 4 : 55 (1984). Type : *Liang 69765*, [copied from protologue :] Guangxi : Fangcheng, Shiwandashan (holo-, SCBI, photo C, original not seen).

Herb, ca. 30 cm, glabrous except for minute brown glands on all vegetative parts, dense on stem, least dense on leaf blades. Stem 4-6-angular and 4-6-ribbed, sulcate, 10-20 cm long. Petiole 3-6.5 cm long. Leaf blade broad to very broad, ovate to elliptic, $9.5-15 \times 6.3-11.5$ cm; base very broadly rounded, apex very broad, rounded to slightly acuminate, margin entire; 5-nerved. Inflorescence subumbellate, 14-17 cm long; peduncle 12-14.5 cm long, distally widening into a small number of 1-3 mm long branches, each carrying a few densely crowded pedicels (inflorescence probably densely scorpioid); bracts subtending inflorescence 2, narrowly ovate, ca. 6 mm long, those subtending flowers linear to subulate, less than 2 mm long; pedicels 1-1.5 cm long in old fruit. Flowers unknown. Old fruit cup-shaped, quadrangular, 8-ribbed, ca. 5.5×5 mm, placental column unbeaked, horns widely spaced, ca. 1.2 mm long, blunt, rod-shaped, curved inwards, placentas thready. Seeds unknown. — Old fruits in late September. — Fig. 6, *A*.

HABITAT : In thicket on sandy soil.

DISTRIBUTION : China (Kwangsi), Vietnam (Tonkin). — Fig. 10, *H*.

SPECIMENS : *Liang 69765*, type (SCBI); *Tsang 26893*, paratype (A, C, K, P).

NOTES : *Phyllagathis scorpiothyrsoides* is a caulescent long-pedunculate species with broad leaves ranging among the broad-leaved species mentioned under *P. tetrandra* (p. 377). It can be recognized by the conspicuously angular ribbed sulcate stem which is brown due to dense

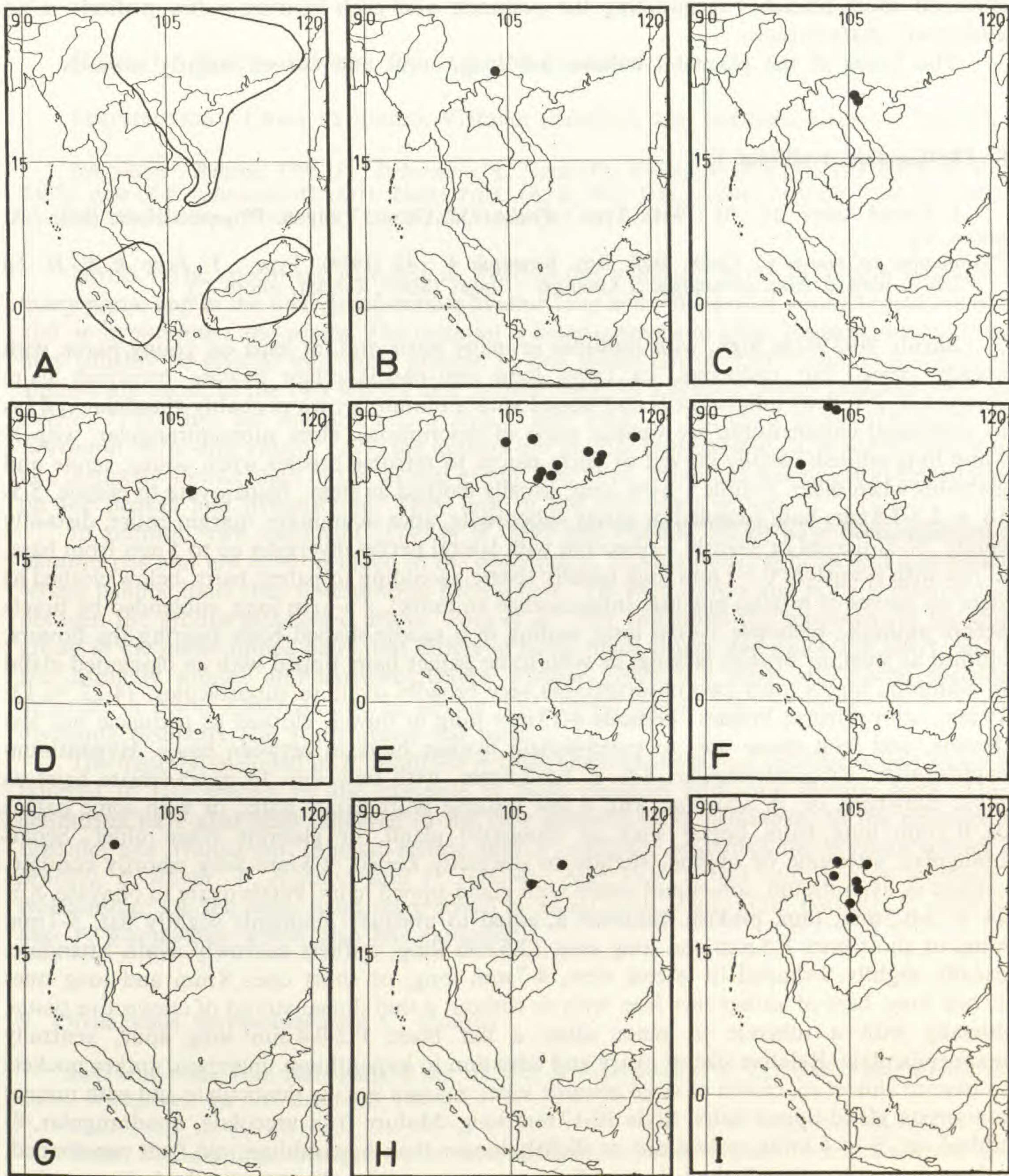


Fig. 10. — *Phyllagathis*, generic and specific total distributions : A, genus; B, *P. tetrandra*; C, *P. tonkinensis*; D, *P. subrotunda*; E, *P. cavaleriei*; F, *P. longipes*; G, *P. wenshanensis*; H, *P. scorpiothyrsoides*; I, *P. ovalifolia*.

minute brown glands. The apparently very reduced scorpioid inflorescence with densely clustered short branches terminating the peduncle and each bearing a few pedicels is an additional characteristic.

The horns of the placental column are long, stout and curved slightly inwards.

8. *Phyllagathis ovalifolia* Li

J. Arnold Arbor. 25 : 31 (1944). Type : *Tsai 61456*, China, Yunnan, Ping-pien Hsien (holo-, A, photo, C).

Phyllagathis calisaurea C. CHEN, Bull. Bot. Research 4 : 45 (1984). Type : *T. Fang & X. H. Lu 23672*, [copied from protologue :] Guangxi : Jingxi (holo-, GXMI, photo C).

Shrub, 90-250 cm high, with raphides in many parts and, at least on young parts, with usually dense, but caducous, ca. 1 mm long uni(-pauci)-seriate hyaline brownish hairs composed of 1(-few) inflated cells and tipped with a minute brown probably glandular cell (as to additional indumentum, see various parts of description). Stem subquadrangular, with 1-3 mm long whitish usually curved or curly patent to retrorse bristles when young, terete and glabrous when older. Petiole 1-6 cm long, usually clothed as stem; blade ovate to elliptic, 5.5-16 × 2.3-7.8 cm; base rounded or rarely subcordate, apex acuminate, margin entire, distantly ciliate; 3(-5)-nerved or slightly 3-plinerved with lateral nerves diverging up to 5 mm from base, above with persistent 0.5-1 mm long usually sparse ascending to patent hairs, below clothed as stem on nerves or bristles missing. Inflorescence an umbel, 2.5-6 cm long, subtended by bracts before anthesis; peduncle 1-4 cm long, ending in a saddle-shaped body bearing the flowers, clothed as stem, or bristles lacking, or with some patent hairs tipped with an elongated gland in addition; bracts (only two observations) very broadly ovate to suborbicular, 14-22 × 13-19 mm, with retrorse bristles; pedicels 8-13 mm long in flower, clothed as peduncle but less densely, and with dense uni- to pauci-seriate hyaline hairs in between bases. Hypanthium campanulate, subquadrangular, 4-6 × 1.5-2.5 mm, with only uni- to pauci-seriate hairs as those elsewhere, or, in addition, with a few retrorse pluri-seriate hairs, or with some patent ca. 0.3 mm long hairs tipped with an elongated gland, or glabrate when older. Sepals triangular, attenuate or oblong, slightly to distinctly keeled, 2-5 mm long, shortly connate, clothed as hypanthium, sometimes ciliate with gland-tipped hairs. Petals ovate to obovate, 8.5-14 × 5-6.5 mm, thin, pinkish. Stamens 8, equal to unequal; filaments slightly flat, 5-7 mm long, or short ones 8.5 mm and long ones 12.5 mm long; anthers narrowly ovate, attenuate, usually slightly S-shaped in lateral view, 4-7 mm long, or short ones 8 mm and long ones 11 mm long, base of anther sacs free, with or without a thin dorsal strand of connective tissue, dorsally with a tubercle or more often a flat blunt 0.2-0.4 mm long spur, ventrally inappendiculate. Relative size of ovary and adnation to hypanthium uncertain, anther pockets to base or almost so, crown of large connate lobes, margin usually denticulate and with minute uni-seriate gland-tipped hairs. Style 10-17 mm long. Mature fruit urceolate, quadrangular, 8-ribbed, ca. 5 × 4.5 mm, valves not or slightly longer than hypanthium, old fruit cup-shaped, subquadrangular, 8-ribbed, 5-7 × 4.5-5.5 mm, placental column unbeaked, horns close together basally, ca. 1.4 mm long, pointed, curved inwards, placentas thready. Seeds obovate, ca. 0.6 mm long, testa slightly tuberculate, brown, beak short, blunt, brown, strophiole dark

brown. — Flowers in July, August and November, old fruits in October. — Fig. 3, C; 5, B; 7, C.

HABITAT : Forests between 700 and 1000 m altitude.

DISTRIBUTION : China (Yunnan), Vietnam (Tonkin), and northern Laos. — Fig. 10, I.

SPECIMENS : *Balansa* 3506 (P); *Delacour s. n.*, Napé (P); *Eberhardt* 3676 (P); *T. Fang & H. Y. Lu* 23672, type of *P. calisaurea* (GXMI); *Henry* 11035 (A, K, NY, US); *Pételot* 7129 (P), 7148 (P); *Pocs et al.* 2591 (P); *Poilane* 27076 (P); *Tsai* 61456, type (A).

NOTES : The specimens included in *Phyllagathis ovalifolia* agree in having raphides in many parts, and in the uni(-pauci)-seriate hyaline long hairs at least on young vegetative parts and on hypanthium and sepals. The material is heterogeneous in other respects, however, and may roughly be divided into three groups. In one group (*Henry* 11035 and *Tsai* 61456) the anthers are equal in the two whorls and 5-7 mm long. In a second group (*Balansa* 3506 and *Pételot* 7148) they are unequal and 8 and 11 mm long. In the third group (*Delacour s.n.*, *Eberhardt* 3676, and *Pételot* 7129) the anthers are slightly unequal and ca. 4 and 4.5 mm long, i.e., distinctly shorter than in the second group. The third group has patent gland-tipped hairs on the pedicel and hypanthium. They lack in the two other groups.

In addition, two specimens (*Pocs et al.* 2591 and *Poilane* 27076) have been regarded as paramorphs and not been included in the description. Having both raphides and uni(-pauci)-seriate hyaline hairs they undoubtedly belong here. Yet each differs and none is intermediate between the groups mentioned above. *Pocs et al.* 2591 resembles the specimens in the third group in the gland-tipped hairs, but differs in being much frailer and much less hairy, and in the distinctly smaller and narrower leaves. *Poilane* 27076 is a stout and coarse specimen differing in being 3-merous and in having 5-plinerved leaves with the inner pair of nerves diverging distinctly (ca. 1 cm) above the base.

The material included in *P. ovalifolia* is truly heterogeneous, but specimens may easily be referred to this species by the presence of both raphides and long hyaline hairs. These characters have also been observed in the type material of *P. calisaurea*. In the presence of raphides and hyaline uni- to pauci-seriate hairs *P. ovalifolia* resembles the Bornean species *B. brookei*, *P. dispar*, *P. elliptica*, and *P. rupicola*. Also their anther morphology indicates a relationship. On the other hand there seems to be no close relationship between *P. ovalifolia* and *P. guillauminii* which also has raphides.

9. *Phyllagathis brevipedunculata* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 38 (1990). Type : *Kerr* 21197, Laos, Wiengchan, Pu Tat (holo-, P, photo C; iso-, BM, K, L).

Herb, 8-15 cm high. Stem terete to subquadrangular, with slightly to much retrorse thin ca. 3 mm long bristles. Petiole 1-2(-4) cm long, clothed below as stem and above with long patent stouter 3-7 mm long bristles. Leaf blade elliptic, 7.7-13.5 × 3.5-6 cm; base narrow, rounded to cordate, apex acute, margin entire to subdenticulate, distantly ciliate; 5-nerved,

above and below with patent either ca. 2 mm long hairs or much shorter bristles, or below clothed as stem on longitudinal nerves. Inflorescence an umbel, 1-2 cm long, subtended by a few bracts when young; peduncle 0.5-1 cm long, clothed as stem, but hairs patent; bracts suborbicular, 3-4.5 mm long and wide, with crenulate serrate margin ciliate with long hairs tipped with a very small gland; pedicel 2-4 mm long in bud, with minute uni-seriate gland-tipped hairs. Flowers known only in bud. Hypanthium cup-shaped, ca. 3.5×4 mm, with minute uni-seriate gland-tipped hairs, and distally at sepalous rim with some long terete emergences, intersepalous ones the largest, covered with up to 3 mm long patent hairs tipped with small elongated glands. Sepals attenuate, ca. 2 mm long, keeled, on keel and apically on margin with same hairs as hypanthium. Petals wide, asymmetrically elliptic, ca. 9×6 mm, thin, ciliate with gland-tipped hairs on apical margin, purple. Stamens 8, slightly unequal; anthers with a blunt, ca. 1.2 mm long spur dorsally, inappendiculate ventrally and without a strand of connective tissue along base of anther sacs. Ovary about half as long as hypanthium (crown excluded) and two thirds as long as hypanthium (crown included), adnate to it for most of its length, anther pockets to base of ovary; crown lobes large, partly connate, subdentate; placental stalks narrow. Style and fruit unknown. — Buds in April. — Fig. 3, I; 11.

HABITAT : In evergreen forest and in bamboo thicket by stream at 400-1200 m altitude.

DISTRIBUTION : Laos. — Fig. 13, A.

SPECIMENS : *Kerr 20919* (BM, K, P), *21197*, type (BM, K, L, P).

NOTES : *Phyllagathis brevipedunculata* can be recognized by the short peduncle, the retrorse bristles on the stem and petioles below and the long stout patent bristles on the petioles above, the bracts ciliate with long hairs, the hypanthial emergences, and the long-calcarate anthers.

Due to the short peduncle the inflorescence looks as if sessile in the wide cleft between the petioles of the apparently distal normal-sized leaf pair. There is, however, an additional node about 1 mm above it with a pair of small leaf-like bracts (blade ca. 7×3 mm, petiole ca. 4 mm long and without the long bristles of the petioles of normal leaves). Such a short peduncle as in *P. brevipedunculata* is elsewhere seen only in *P. ovalifolia*, *P. melastomatoides*, *P. sessilifolia*, *P. setotheca*, *P. tentaculifera* and *P. driessenioides* none of which are closely related to *P. brevipedunculata*.

In *Kerr 21197* the stem and petioles below have much appressed retrorse bristles, so that at a rapid glance these parts look glabrous, while in *Kerr 20919* the bristles at first are patent then curve backwards. Other species with a retrorse indumentum are mentioned under *P. tonkinensis*.

In common with *P. prostrata* and *P. longicalcarata*, *P. brevipedunculata* has long filiform hypanthial emergences clothed with long hairs, at least distally. The three species differ as given in the key (leads 11 and 12). Three other Indo-Chinese species of *Phyllagathis*, *P. sessilifolia*, *P. marumiaetricha* and *P. guillauminii*, have emergences, but they are very different.

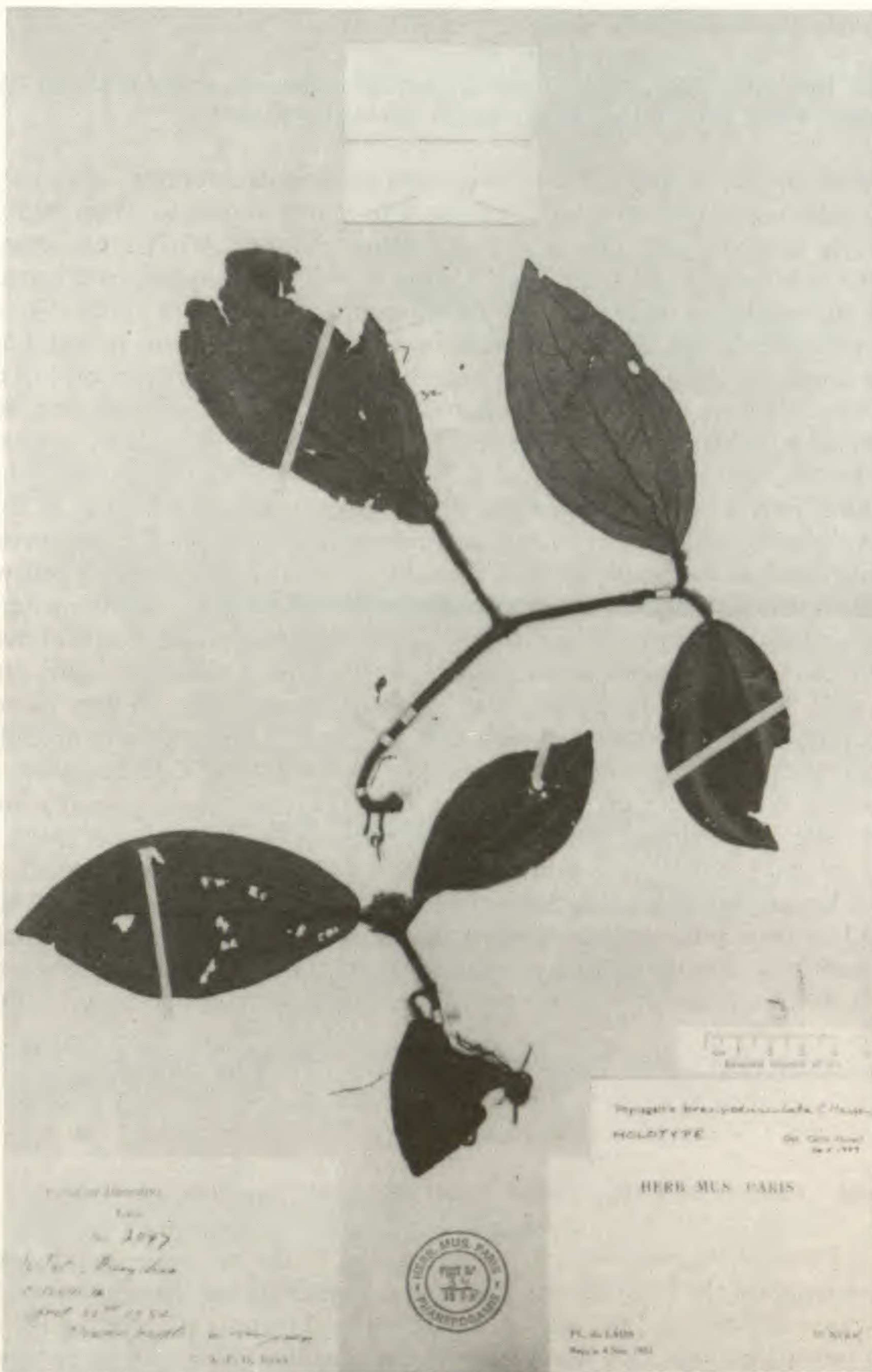


Fig. 11. — *Phyllagathis brevipedunculata*, holotype.

10. *Phyllagathis prostrata* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 39 (1990). Type : *Poilane 30047*, Vietnam, Quangtri Province, Đông Tam Pe (holo-, P, photo C).

Herb. Stem prostrate, up to 30 cm long, subquadrangular, rooting, leafy or not, with a distal and sometimes a few lateral erect leafy and flowering shoots to 15 cm high, with up to 2.5 mm long, or at nodes to 4 mm long, patent hairs. Petiole 1.4-1.7(-5) cm long, clothed as stem. Leaf blade broadly ovate to elliptic, 3-5.6(-8.5) × 1.7-4(-5.8) cm; base broadly cordate, apex obtuse to broadly rounded, margin usually entire; 3-nerved, or rarely 3-plinerved with lateral pair of nerves diverging 3-5 mm from base, both surfaces with patent 1.5-2 mm long hairs; blade sometimes bulging upward at each hair base lifting the hairs on top of a narrow conical elevation hollow from below. Inflorescence an umbel, 2.5-5 cm long, with flowers subtended by a few bracts; peduncle slender, 2-3 cm long, clothed as stem, but hairs sparser; bracts very broad, deltoid to cordate, 3.5-8 × 5-9 mm, with minute glands and long hairs; pedicel 1-4 mm long. Flowers 4-5-merous. Hypanthium campanulate, 4-5 × 2-3 mm, with minute brown glands, and distally at sepalous rim with some filiform emergences, intersepalous ones long, and all over with up to 2.5 mm long patent hairs, rarely tipped with a small elongated gland, basally on surface, distally also on emergences. Sepals attenuate, ca. 1-2 mm long, keeled, with hairs as hypanthium on keel and especially apically. Petals obovate, tending to be clawed, ca. 8 × 3.5 mm, with a few gland-tipped hairs apically dorsally, pink or white with some pink. Stamens 8-10, equal; filaments 4.5-5.5 mm long; anthers narrowly ovate, attenuate, curving slightly backwards below and with a slight bend forward apically, ca. 5 mm long, base of anther sacs not free, connective extended for 0.2-0.3 mm below anther sacs widening basally and usually produced into a triangular short spur dorsally and into two upwards bending terete lobes ventrally. Ovary 4-5-locular, about one third as long as hypanthium (crown excluded) and half as long as hypanthium (crown included), adnate to it for the whole length, anther pockets about half-way to base; crown lobes large, fully connate, edge denticulate with some minute uni-seriate gland-tipped hairs; placental stalks narrow. Style 12-14 mm long, stigma capitulate. Fruits young, phyllagathoid (see characteristics and delimitation). Seeds unknown. — Flowers in June, young fruits in February. — Fig. 3, *H*; 12.

HABITAT : By river or on granite in forests at 250-700 m altitude.

DISTRIBUTION : Vietnam. — Fig. 13, *B*.

SPECIMENS : *Clemens 3479* (P); *Poilane 10783* (P), *30047*, type (P), *31631* (P).

NOTES : *Phyllagathis prostrata* can be recognized by the prostrate rooting stem and the emergences distally on the hypanthium. Additional characters are the very broad hairy bracts persistent during anthesis and the distinct extension of the connective below the anther sacs. Two of the four collections, i.e., *Clemens 3479* and *Poilane 10783*, can be recognized by the distinct conical upward bulges of the lamina, not observed in any other species of *Phyllagathis*, but also seen in two Indo-Chinese *Allomorpha* species.



INSTITUT DES RECHERCHES
AGRONOMIQUES ET FORESTIÈRES
Recherches: E. POHLANI
n° 30047

Phyllagathis prostrata
C. Hansen
C. Hansen: Dong Son, 8th Indochine
near a mangrove 15-6-39



HERB. MUS. PARIS

Phyllagathis prostrata C. Hansen
HOLOTYPE

det. C. Hansen
22.7.1971

P. JENKINS
Rep. to 20 April 1971

Collect. E. POHLANI

Fig. 12. — *Phyllagathis prostrata*, holotype.

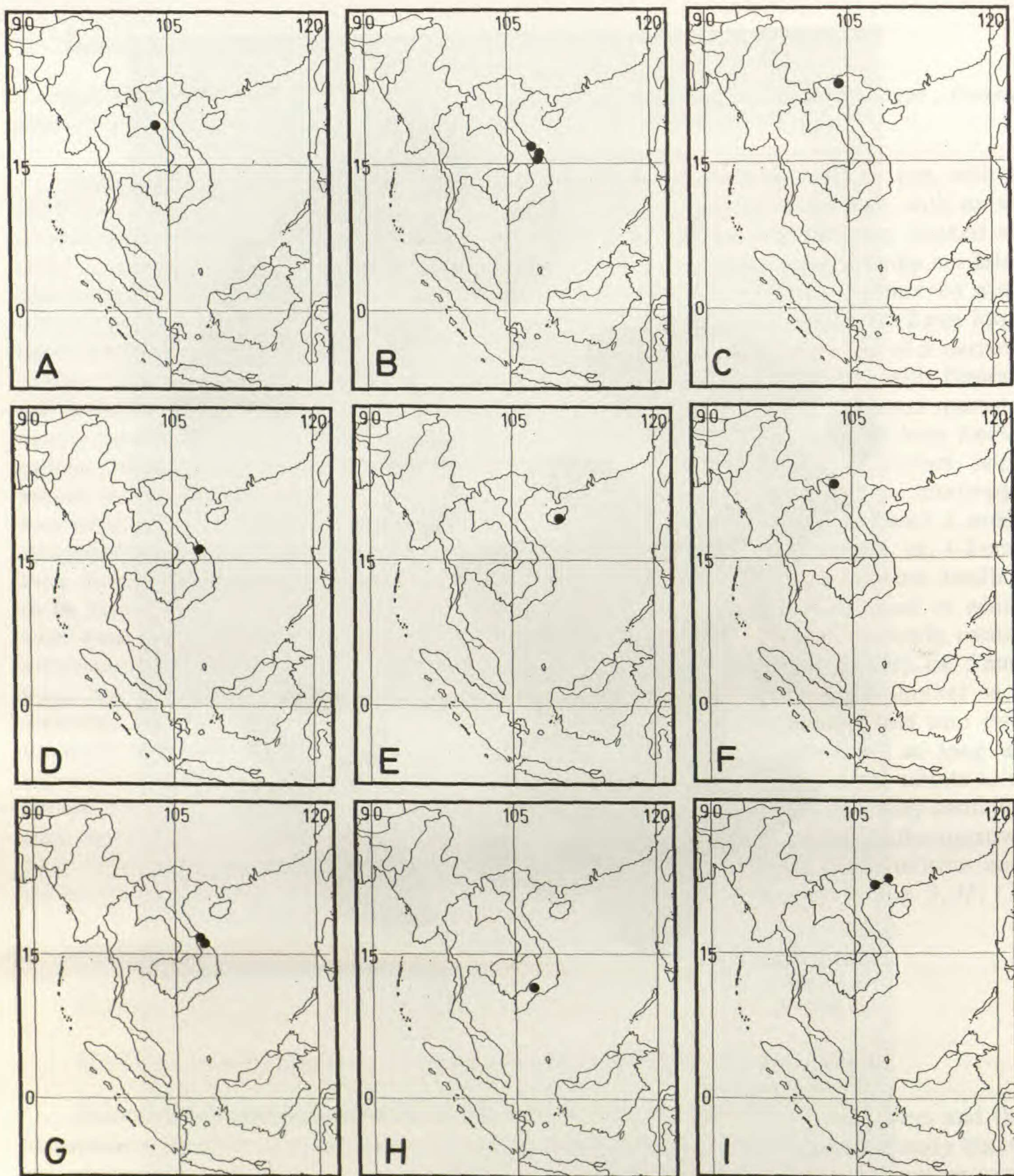


Fig. 13. — *Phyllagathis*, specific total distributions : A, *P. brevipedunculata*; B, *P. prostrata*; C, *P. longipes*; D, *P. sessilifolia* and *P. marumiaetrica*; E, *P. melastomatoides*; F, *P. dichotoma*; G, *P. suberalata*; H, *P. guillauminii*; I, *P. setotheca*.

11. *Phyllagathis longicalcarata* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 39 (1990). Type : *Pételot* 7099, Tonkin, Chapa (holo-, P, photo C).

Shrub (?), branched, height unknown. Branchlets subquadrangular, with dense curly whitish up to 1.5 mm long patent bristles. Petiole 0.7-3 cm long, clothed as stem. Leaf blade broadly ovate, 8-11 × 4.5-8 cm; base rounded to subcordate, apex acuminate, margin entire to subdentate; 3-5-nerved, above with appressed about 1 mm long bristles mixed with about 0.1 mm long erect bristles, below clothed as stem, but hairs less curly and on older leaves much less dense. Inflorescence an umbel, ca. 4.5 cm long; peduncle ca. 2 cm long, clothed as stem; bracts two subtending umbel, leaf-like, ovate, 1.8-3.5 × 0.5-1.5 cm, clothed as leaves, and several subtending pedicels, narrow, ca. 2 mm long, ciliate with ca. 1 mm long hairs; pedicels ca. 15 mm long in flower, with minute brown glands and patent almost straight bristles. Hypanthium cup-shaped, ca. 6.5 × 5 mm, with minute brown glands, patent bristles of various sizes and, from base upwards, dense patent 2-3 mm long filiform emergences clothed with minute brown glands and patent hairs of various sizes. Sepals ligulate, slightly keeled, ca. 2.5 × 2 mm, with bristles especially on keel and margin. Petals very widely obovate, ca. 10 × 8 mm, with dense ca. 1 mm long bristles dorsally apically, apical one very stout, colour unknown. Stamens 8, equal; filaments ca. 8 mm long; anthers narrowly ovate and curved ventrally, ca. 6.5 mm long, base of anther sacs not free, connective with a slightly curved pendant ca. 1.5-2 mm long dorsal spur and two free terete ventral lobes directed obliquely upwards and adnate to base of anther sacs exceeding them in a blunt tubercle. Ovary about half as long as the hypanthium (crown excluded) and about as long as hypanthium (crown included), adnate to it for its whole length, anther pockets to base of ovary; crown lobes shortly connate, with dense long stout hairs on edge and around base of style and a few in between; placental stalks compressed. Style ca. 16 mm long, stigma capitulate. Fruit and seeds unknown. — Flowers in July. — Fig. 3, *F*; 14.

HABITAT : Light forest at about 1800 m altitude.

DISTRIBUTION : Vietnam (Tonkin). — Fig. 13, *C*.

SPECIMENS : *Pételot* 1393 (P), 3088 (BM, K), 7099, type (P).

NOTES : *Phyllagathis longicalcarata* can be recognized by the very long filiform hairy emergences occurring all over the hypanthium. Another equally good character is the long hairs on the edge of the ovary crown, on the inside, and densely around the base of the style.

The long spur of the anther, however, to which the name refers, occurs also in several other species such as *P. brevipedunculata*, *P. guillauminii*, *P. prostrata*, *P. setotheca*, *P. tetrandra*, *P. truncata*, *P. megalocentra* and *P. driessenioides*.

The hypanthium and ovary crown (with their characteristic indumentum) as well as the stamens of *Bredia hispidissima* C. Chen (*Phyllagathis hispidissima* (C. Chen) C. Chen) as drawn in CHEN (1979, 1984) are very similar to the respective parts in the species described

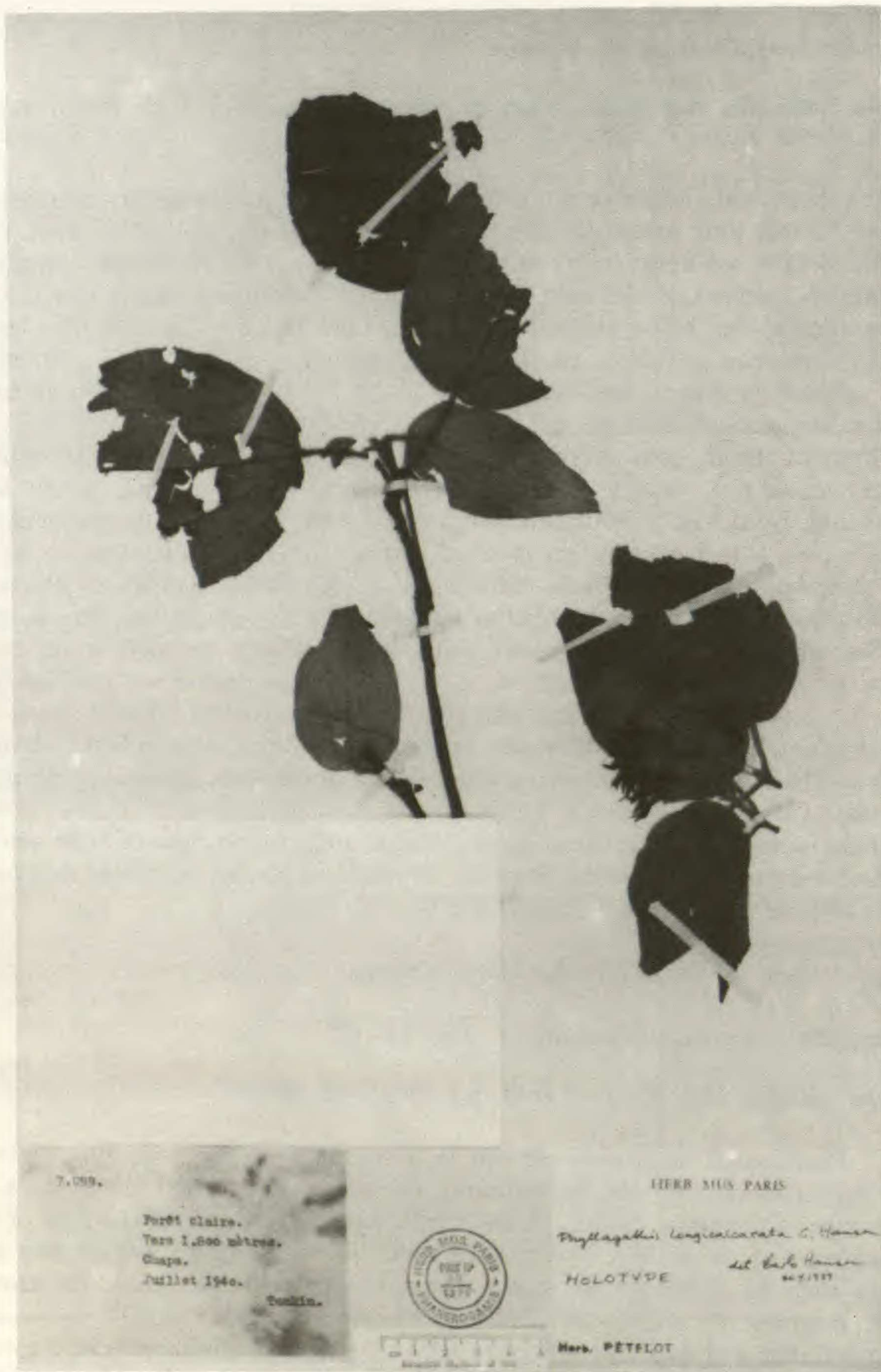


Fig. 14. — *Phyllagathis longicalcarata*, holotype.

here. The two species seem to disagree in habit, however, since according to the diagnosis *B. hispidissima* is a stoloniferous plant with unbranched stem, while the present species branches and almost certainly is shrubby and non-stoloniferous.

The type of *B. hispidissima* (Mao 4192) is the upper part of a plant in young bud with three nodes, the upper one terminal or subterminal, each with a pair of fully developed leaves. In the axils of the two lower leaf pairs are bracteate clusters of buds on short peduncles. It cannot be decided whether the cluster of buds apically on the plant is terminal or axillary because of the dense indumentum.

The most conspicuous characteristic of Mao 4192 is the 2-4 mm long bristles on the internodes and the 7-13 mm long and to 0.4 mm thick bristles on the nodes. Similar, though only 1-1.5 mm long, but still stout bristles (and no stellate emergences) occur on the margin and back of the sepals. Hairy emergences are found on the hypanthium. The only other notable floral characteristic is a low rim inside the sepals. A similar structure has been observed elsewhere only in specimens of *Sporoxeia*.

Certainly Mao 4192 is not the same species as *P. longicalcarata*, and it is hardly the species illustrated by CHEN (1979, 1984), which has sepals with stellate emergences and no rim inside the sepals. The illustrated specimen closely resembles *P. longicalcarata* in the hypanthium and broad sepals both with stellate emergences, and the long hairs on the edge of the ovary crown. None of the several paratypes of *P. hispidissima* has been available to me.

12. *Phyllagathis sessilifolia* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 39 (1990). Type : *Poilane* 27614, Indochine, Nui Bach Ma station d'altitude de Huê (holo-, P, photo C).

Little-branched shrublet, 20-100 cm high, glabrous except for sparse minute brown glands, at least on young parts, and a cushion of dense long uni-seriate brown hairs in leaf axils and along line connecting leaf bases. Branchlets compressed at least below nodes, when young, terete, often with two opposite ridges, when older. Leaves sessile or in one specimen petiole up to 3 mm long; blade ovate to elliptic, 6.5-14.5 × 3.5-5.5 cm; base broadly cordate, apex acuminate, margin entire; 3-5-nerved. Inflorescence an umbel, 4-9 cm long; peduncle (0-)1.7-5 cm long; bracts usually two, opposite, ovate to broadly ovate, 0.7-2.5 × 0.4-2 cm; pedicel from 1.5 cm in flower to 2.5 cm long in fruit. Hypanthium urceolate, 4.5-6 × 2.7-3.5 mm, uneven to bullate or at least upper half with much irregular more or less fleshy emergences of various shape and size; sometimes with spheroidal brown sessile to stipitate glands on surface or on emergences, one or more on each. Sepals ligulate, 2-3 × ca. 2 mm, middle part thickened with surface and indumentum as hypanthium. Petals asymmetrical, obovate, shortly acuminate, 7.5-10 × ca. 7 mm, white to pink. Stamens 8, unequal; filaments slightly flat, 5-7 mm and 6-9 mm long; anthers narrowly ovate, attenuate, curved to ventral side, ca. 5.5 and 6.5-7.5 mm long unstraightened, connective basally produced into a tubular collar surrounding insertion of filament, with a tubercle or short flat spur dorsally and two lobes ventrally. Ovary about half as long as hypanthium (crown excluded) and about three quarters as long as hypanthium (crown included), adnate to it for its whole length, 4 anther pockets almost to base of ovary, alternating with 4 slightly less deep, ovary crown large, lobes



HERBARIUM DES MUSEUMS
NATURALIENS DE PARIS

27614

A. 2. Longue montagne
 Plante à 2.40 à 2.50 de h
 Il pousse en sous-bois tenant sur le rocher
 dominant le marais de Hin Bock Ma. Station
 d'altitude au pied du mont de Hui 6-9-38
 les seules fleurs de couleur corollaire, pétale



HERB. MUS. PARIS

Phyllagathis sessilifolia C. Hansen
 HOLOTYPE del. Carl Hansen
 24-7-38

Dr. E. H. WHEELER
 Dec 20, 1938

Fig. 15. — *Phyllagathis sessilifolia*, holotype.

fully connate, edge with small gland-tipped hairs; placentas slightly protruding into ovary on short compressed stalks. Style 13-16 mm long, glabrous or with sparse minute uni-seriate gland-tipped hairs. Mature fruit cup-shaped, not or only faintly ribbed, ca. 8 × 7 mm, old fruit campanulate, 6-8.5 × 6-7 mm, placental column unbeaked, horns close together basally, ca. 0.8 mm long, pointed, curved outwards, placentas thready. Seeds obovate, slightly angular, 0.8-1 mm long, testa tuberculate, brown, or light brown apically, beak short, blunt, light brown, strophiole dark brown. — Flowers in February, June and September, fruits in August, September and December. — Fig. 2, *G*; 3, *J*; 7, *B*; 15.

HABITAT : In forests on poor acid clayey shaly soil at 1200-1500 m altitude.

DISTRIBUTION : Vietnam (Annam). — Fig. 13, *D*.

SPECIMENS : *Clemens* 4186 (BM, K, P); *Poilane* 1537 (P), 27614, type (P), 27680 (P), 28997 (P), 29673 (P), 31098 (P), 31208 (P); *Vidal* 979A (P).

NOTES : *Phyllagathis sessilifolia* is a characteristic species that can be recognized by the sessile or subsessile broad leaves or by the cushions of uni-seriate hairs in the leaf axils. Some collections can be referred to *P. sessilifolia* solely on the basis of their peculiar hypanthial emergences. Its compressed glabrate internodes also are a good character.

Only two other species, *P. suberalata* and *P. guillauminii*, may have petioles as short as 1 mm. They are very different from *P. sessilifolia*.

Minute brown glands occur sparsely on young vegetative parts and on the hypanthium and sepals, but they soon disappear, though remnants may occasionally be seen. The cushions of hairs in the leaf axils are distinct but usually hidden by the cordate bases of the sessile leaves. Therefore the species looks totally glabrous.

The surface of the hypanthium in flower is uneven or even bullate. In four specimens (*Clemens* 4186, *Poilane* 1537, 27680 & 28997) the unevenness becomes so marked that the elevations appear as irregular emergences. In addition, in the same four specimens and in *Poilane* 27614 spheroidal brown glands that are sessile or rarely stipitate occur on the surface of the hypanthium and apically also laterally on tubercles or as projections on larger emergences.

13. *Phyllagathis melastomatoides* (Merr. & Chun) Ko

In CHUN, Acta Phytotax. Sin. 8 : 267 (1963).

Osbeckia melastomatoides MERR. & CHUN, Sunyatsenia 2 : 293 (1935). Type : *Chun & Tso* 44310, Hainan, Mocheung Leng (holo-, A).

Branched shrub, to 3 m high. Branchlets terete or subquadrangular, with sparse appressed or ascending to patent bristles of various sizes from very short to about 4 mm long, or at nodes to 8 mm long, when young, glabrous when older. Petiole 1-5(-7.5) cm long, clothed as stem but bristles to 7 mm long. Leaf blade ovate to elliptic, (5-)9-13.5 × 3-5 cm; base acute, apex shortly acuminate, margin entire with appressed bristles; 3-5-nerved, or rarely 5-plinerved with inner pair of nerves diverging 5-10 mm from base, outer pair at base, above sometimes with

sparse appressed to ascending 0.5-2.5 mm long bristles, below with appressed or ascending to patent to 3 mm long bristles mainly on nerves. Flowers solitary or 2-3 together; peduncle 0.2-0.6 cm long, clothed sparsely as stem; bracts subtending flowers 2, usually ovate, ca. 4-9 × 1-5 mm, usually with only marginal bristles; pedicel 4-12 mm long in flower, 5.5-15 mm long in old fruit. Hypanthium cup-shaped, 5-6.2 × 2.5-3 mm, with minute brown glands and sparse 1-3 mm long appressed or patent soon upwards bending bristles. Sepals long attenuate, 5-7 mm long, clothed as hypanthium. Petals broadly obovate, 13-18 × 8-10 mm, rounded apically, ciliate from ca. 0.4 mm long gland-tipped hairs, pink. Stamens 8, subequal; filaments ca. 6.5 mm long; anthers narrowly ovate, curved to ventral side, ca. 6.5 mm long, connective basally forming a collar around insertion of filament slightly below anther sacs, with a dorsal narrow short spur and two rounded ventral lobes. Ovary about half as long as hypanthium (crown excluded) and almost as long as hypanthium (crown included), adnate to it for its whole length, anther pockets to base of ovary; crown large, lobes fully connate, edge ciliate from gland-tipped hairs; placentas slightly protruding into the locules, on slightly vertically elongated stalks. Style 13-15 mm long. Mature fruit not known, old fruit cup-shaped, 8-ribbed, 6-9 × 5-7 mm, placental column very shortly beaked, horns close together, ca. 1.2 mm long, slender, placentas thready. Seeds unknown. — Flowers from November to April, old fruits in January, October and December. — Fig. 1, *G*; 4, *H*; 6, *B*.

DISTRIBUTION : China (Hainan). — Fig. 13, *E*.

NOTES : Among the other two Hainan species of *Phyllagathis*, *P. melastomatoides* resembles *P. stenophylla* in being a large shrub and in having the flowers solitary or 2-3 together. *Phyllagathis melastomatoides* differs distinctly, however, in the conspicuous indumentum of bristles in addition to minute brown glands.

In general appearance the species looks like a *Melastoma*, but it differs in many respects from that genus, most readily in the absence of lines of crystalliferous cells at the hair bases on the upper leaf surface and in the dry capsular fruit.

On the basis of the available material it seems justified to accept that the specimen with ascending to patent bristles and a short pedicel is a variety of its own. The variety differs also in the size of the hypanthium in flower and the size of the old fruit.

a. var. **melastomatoides**

Bristles on stem and petioles appressed, to 4 mm long. Leaves 5-nerved or rarely 5-plinerved. Pedicel ca. 12 mm long in flower, and ca. 15 mm long in fruit. Hypanthium in flower ca. 6.2 × 2.5 mm. Old fruit ca. 8.5 × 6.5 mm. — Flowers and fruits from November to January.

HABITAT : By streams in forests at 1000 m altitude.

SPECIMENS : *Chun & Tso* 44310, type (A); *Liang* 64182 (A, NY), 64810 (A, NY, P); *Wang* 34643 (NY), 35861 (A, NY).

b. var. **brevipes** Ko

In CHUN, Acta Phytotax. Sin. 8 : 268 (1963). Type : *Wang 35035*, Hainan (holo-, ?; iso-, NY).

Bristles on stem and petioles ascending to patent, to 8 mm long at nodes and to 7 mm long on petiole. Leaves 3-nerved. Pedicel from 4 mm long in flower to 5.5 mm long in old fruit. Hypanthium ca. 5 × 3 mm in flower. Old fruit ca. 6.5 × 5 mm.

HABITAT : Forest near stream at 350 m altitude.

SPECIMENS : *How 72029* (A, G); *Lau 28024* (A); *Wang 35035*, type (NY).

14. **Phyllagathis dichotoma** C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 39 (1990). Type : *Poilane 27081*, Tonkin, Le Pan Nhon près de Lai Chên (holo-, P, photo C).

Dichotomously branched shrub, 1.2 m high. Branchlets slightly compressed, with variously stout slightly curly 1-3 mm long subappressed to ascending bristles and patent to 6 mm long bristles at nodes, when young, terete and glabrous when older. Petiole 1-2.8 cm long, clothed as stem but some 3-5 mm long bristles spreading. Leaf blade ovate, 7-10 × 2.7-3.6 cm; base broadly rounded to subcordate, apex acuminate, margin entire; 5-nerved, above with sparse patent 0.5-1.2 mm long bristles, below clothed as petiole. Inflorescence few-flowered, subumbellate (see notes), ca. 2 cm long; peduncle less than 5 mm long, with indumentum as on stem; bracts narrowly ovate, 3-4 × 0.5-1.5 mm, ciliate with long bristles, glabrous above, hairy beneath, persistent in old fruit; pedicel 16 mm long in old fruit, with 1-3 mm long patent bristles. Flowers unknown. Old fruit cup-shaped, 8-ribbed, ca. 6 × 7.5 mm, crown with a few short hairs on edge, placental column unbeaked, horns ca. 0.5 mm long, bluntly stoutly rod-shaped, slightly curved inwards, persistent part of hypanthium with long patent bristles; placentas thready. Seeds unknown. — Old fruits in January. — Fig. 5, G; 16.

HABITAT : Poor shaly soil on ridge at 1500 m altitude.

DISTRIBUTION : Vietnam, known only from the type. — Fig. 13, F.

NOTES : *Phyllagathis dichotoma* can be recognized by the indumentum of bristles, subappressed to ascending on the internodes and patent to 6 mm long at the nodes, and by the short very thick horns of the columnar beak in the old fruit. A central axis of the old fruit with such thick horns has not been observed in any other species. The species has lobe-like elevations at the nodes.

In habit, the species comes close to *P. melastomatoides*, but differs in the much more spreading indumentum and the rounded to subcordate leaf bases.

The inflorescence apparently has an axis of less than 1 cm, with a terminal and a lower node a few millimetres apart, both with some bracts and a few scars from pedicels. In the only specimen available two inflorescences each have a single old fruit; in a third, which is the one that could be studied without destroying the material, none is left.



Fig. 16. — *Phyllagathis dichotoma*, holotype.

15. *Phyllagathis suberalata* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 39 (1990). Type : *Poilane* 29758, Annam, Nui Bach Ma station près de Huê (holo-, P, photo C).

Little to much branched ascending shrublet or erect shrub about 20-100 cm high, with very sparse minute brown glands, at least on young vegetative parts, rarely with any other indumentum (except the leaf margin). Branchlets distally 4(-6)-angular with as many ribs that become low corky wings proximally, older branchlets terete with remains of wings. Leaves unequal, rarely subequal, in a pair; petioles 1-2(-8) mm and 1-4(-10) mm long; blades usually elliptic to narrowly elliptic, smaller ones 0.8-1.4(-5) × 0.2-0.6(-1.5) cm, larger ones 2.2-7.8(-9.5) × 0.5-1.5(-2.4) cm; base cuneate to acuminate, apex acuminate to long acuminate, rarely obtuse, margin entire or sometimes distantly subdenticulate with teeth ending in a short stout bristle, slightly revolute; 3-nerved or (in *Clemens* 3896) 3-plinerved. Flowers solitary, in pairs or three together; peduncle 1-9 mm long; bracts narrowly ovate to elliptic or subulate, 1-8 × 0.7-1.5 mm; pedicel 2-6 mm long, longest in fruit. Hypanthium cup-shaped, quadrangular, ca. 4 × 2 mm. Sepals wide at base, abruptly narrowed into a linear lobe, 8-10 mm long, connate for ca. 0.2 mm. Petals elliptic or ovate, ca. 8 × 3.5 mm, narrowly attenuate, pinkish. Stamens 8, slightly unequal; filaments slightly flat, 5-6.5 mm long; anthers slightly unequal, very narrowly ovate, bending slightly forward apically, 4.5-6 mm long, connective ventrally ending in two small auricles, dorsally in a ca. 0.2 mm long spur above auricles. Ovary about half as long as hypanthium (crown excluded) and two thirds as long as hypanthium (crown included), adnate to it for about half its length, 4 anther pockets to base of ovary and 4 less deep; crown large, lobes fully connate; placentas slightly protruding into locules on vertically elongated stalks. Style 10-14 mm long. Mature fruit cup-shaped, quadrangular, 8-ribbed, 4.5-6.5 × ca. 4.5 mm, old fruit campanulate, subquadrangular, 5-8 × 4.5-6 mm, placental column shortly beaked, horns close together basally, ca. 0.4 mm long, pointed, curved inwards, placentas thready. Seeds, cuneate, angular, ca. 0.9 mm long, testa slightly tuberculate, brown, beak absent, strophiole absent or inconspicuous. — Flowers in April & October, fruits in April & September. — Fig. 1, *F*; 4, *F*; 17.

HABITAT : Rocks by streams in forest in summit area between 1000 and 1500 m altitude.

DISTRIBUTION : Vietnam, around Huê and Dang Na (Tourane). — Fig. 13, *G*.

SPECIMENS : *Clemens* 3896 (K, P), 4227 (K, P); *Poilane* 27666 (P), 27670 (P), 29051 (P), 29758, type (P), 31138 (P); *Vidal* 785A (P).

NOTES : *Phyllagathis suberalata* can be recognized by the corky wings on slightly old branchlets and by the very narrow glabrous sepals about twice as long as the hypanthium. Only *P. tentaculifera* has sepals as long and narrow, but they are clothed with bristles.

Stout up to 0.5 mm long bristles terminate the teeth on the leaf margin in *Clemens* 4227 and *Poilane* 29051 and some ca. 0.3 mm long uni-seriate hairs occur in the leaf axils in *Poilane* 29758. Otherwise the only indumentum is minute brown glands; these are very sparse and cannot be observed with the unaided eye.

The two whorls of stamens are slightly unequal, but due to the scarce material the difference in size was not measured. The anthers differ less than 1 mm in length.

16. *Phyllagathis guillauminii* Li

J. Arnold Arbor. 25 : 29 (1944).

Phyllagathis hirsuta GUILLAUMIN, Notul. Syst. (Paris) 2 : 325 (1913), *non* COGN. (1894). Types : *Pierre s.n.*, Cochinchine, Bien Hoa, Bao Chianh (lecto-, P, photo, C); *s.n.*, [copied from protologue :] Annam : Hue? (syn-, P, not seen).

Shrub, height unknown, with raphides in many parts. Branchlets compressed, with ascending to patent 1-1.5(-2.5 at nodes) mm long bristles, terete when young, slightly corky-ribbed and glabrous when older. Petiole 1-10 mm long, clothed as young stem. Leaf blade narrow, elliptic, 2.5-3.5(-6) × 0.7-1.4 cm; base acute to cuneate, apex acuminate, margin entire; 3-nerved, both surfaces with sparse patent ca. 1 mm long bristles. Flowers solitary or in pairs; pedicels ca. 3.5 mm in flower, 16 mm in old fruit, distally with some patent hairs. Hypanthium cup-shaped, ca. 3.5 × 3 mm, with sparse minute brown glands and dense ca. 1 mm long patent brown bristles situated on the hypanthium or, especially upwards, also on stout fleshy short emergences, one hair on top of each or distally sometimes a few on each. Sepals ligulate, 7 × 3 mm, shortly connate, thin, with sparse minute brown glands on both surfaces and with a few long bristles in addition on the outside and on margin. Petals (one observation) 10 × 7 mm. Stamens (all incomplete) 8, most likely equal; anthers narrowly ovate, more than 6 mm long, connective basally widened and prolonged for ca. 1 mm below anthers with a straight pendant ca. 1 mm long spur dorsally, and two auricles ventrally; pore 1. Ovary half as long as hypanthium (crown excluded) and three quarters the length of hypanthium (crown included), partially adnate to it for its whole length, anther pockets to base of ovary, crown large, lobes fully connate, tough basally, with dense ca. 1 mm long hairs on edge; placentas shortly stalked. Style ca. 15 mm long. Old fruit cup-shaped, 8-ribbed, ca. 5 × 4.5 mm, placental column unbeaked, horns close together, ca. 2 mm long, acicular, placentas thready. Seeds unknown. — Flowering season unknown. — Fig. 2, *H*; 4, *E*; 5, *F*.

HABITAT : Unknown.

DISTRIBUTION : Vietnam (Annam, Cochinchine). — Fig. 13, *H*.

SPECIMEN : *Pierre s.n.*, type (P).

NOTES : *Phyllagathis guillauminii* can be recognized by the stout fleshy short hypanthial emergences each with one or a few hairs, by the ligulate sepals about twice as long as the hypanthium, by the long hairs on the edge of the ovary crown, and by the long acicular horns of the placental column.

The emergences cannot be confused with the filiform emergences found elsewhere (*P. prostrata*, etc.) or with the characteristic ones of *P. sessilifolia*.

Long hairs on the edge of the ovary crown have been observed elsewhere only in *P.*

longicalcarata, which differs in having hairs also on the inside of the crown, and in having dense filiform emergences on the entire hypanthium.

Phyllagathis guillauminii and *P. suberalata* are much alike in being shrubby, narrow-leaved and in having flowers solitary or in groups of up to three. Besides the characteristics given for each, the hairiness of *P. guillauminii* offers a good distinction.

Contrary to the opinion of GUILLAUMIN (1913), as given in the protologue, *P. guillauminii* seems not to be closely related to the other species, mentioned under *P. ovalifolia*, which have raphides. It differs in having hypanthial emergences, in lacking the characteristic uni-pauciseriate brown hairs, and in having ventral staminal appendages.

Phyllagathis hirsuta Cogn. is a synonym of *P. gymnantha* Korth.

17. *Phyllagathis setotheca* Li

J. Arnold Arbor. 25 : 32 (1944). Type : Liang 69817, China, Kwangtung, Shih Wan Tai Shai (holo-, A, photo C).

Herb or shrublet, 30-60 cm high, glabrous on all vegetative parts except for very sparse minute brown glands when young and for hairs of inflorescence and sepals (see below). Stem quadrangular, sometimes with four faint ribs and with an additional ridge on two opposed sides from decurrent leaf bases. Petiole 1-2.5(-3.5) cm long. Leaf blade obovate, or rarely elliptic, 9-15.5 × 2-4.5 cm; base narrowly acute, apex acuminate, margin entire; 3-nerved. Inflorescence an umbel, 2-7 cm long, subsessile or peduncle up to 3.5 cm long; bracts 4-6, forming an involucre closely subtending the flowers, ovate to suborbicular, sessile, 10-25 × 5-10 mm, persistent, outer pair often leaf-like; pedicels from 9 mm in flower to 25 mm in fruit, with bases surrounded by dense multiseriate long brownish hairs, stout on basal part, then abruptly narrowed into a long curly thin part. Hypanthium narrowly campanulate, subquadrangular, 4-5.5 × 2.5-3.5 mm, glabrous or with very sparse minute glands. Sepals usually widely attenuate, acute apically and pointed into a small gland-tipped hair, 2.5-3.5 mm long, lobes connate for about 0.4 mm, clothed as hypanthium, and sometimes, in addition, with some intersepalous hairs like those between the bases of pedicels, and with dense uniseriate brownish hairs along margin, at least apically. Petals broadly obovate, ca. 10 × 6 mm, thin, pinkish. Stamens 8, equal; filaments slightly flat, 4.5-7 mm long; anthers narrowly ovate, curved to ventral side, ca. 6 mm long, connective dorsally with a narrow tapering pointed 0.7-1 mm long spur, ventrally with two ridges or small auriculate lobes in angle between anther sacs and filament. Ovary half as long as hypanthium (crown excluded) and about three fourth the length of hypanthium (crown included), partially adnate to it for three thirds its length, anther pockets to base of ovary; crown of four fully connate lobes with minute brown glands on edge; placentas narrowly stalked. Style ca. 10-15 mm long, glabrous or with sparse minute uniseriate glandular hairs on basal half. Mature fruit campanulate, subquadrangular, 8-ribbed, ca. 6.5 × 5(-7.5) mm, valves equalling or exceeding hypanthium by up to 1.5 mm, old fruit cup-shaped, 8-ribbed, ca. 8 × 6 mm, placental column shortly beaked, horns with a thick base and an acicular outer part, ca. 1 mm long, placentas thready. Seeds cuneate to obovate to oblong, ca. 0.7 mm long, testa tuberculate, beak absent or indistinct. — Flowers from May to July, fruits from August to October. — Fig. 3, G; 5, A; 6, D.

HABITAT : On wet sandy soil in thickets; altitude unknown.

DISTRIBUTION : China (Kwangtung) and Vietnam (Tonkin). — Fig. 13, *I*.

SPECIMENS : *Liang* 69817, type (A); *Tsang* 26914 (A, C, E, K, P), 27257 (A, P), 28999 (A, C, E, P), 29059 (A, C, K, P), 29354 (A, C, E, K, P), 30043 (A, C, E, G, K, P, UPS), 30349 *A* (A, C, E, G, P).

NOTES : *Phyllagathis setotheca* is one of the species with no indumentum on the stem and leaves other than minute glands and can be recognized among them by the dense long brownish hairs in between the bases of the pedicels. An involucre of several bracts subtending the inflorescence and persistent also in old fruits is an additional character, though not unique to this species.

Dense brown hairs in between the bases of the pedicels are also seen in *P. ovalifolia*, but in that species they are hyaline and uni- or pauci-seriate.

The minutely stellate-pubescent indumentum attributed to the species in the protologue has not been observed.

As to *P. setotheca* var. *setotuba* C. Chen, see p. 423.

18. *Phyllagathis stenophylla* (Merr. & Chun) Li

J. Arnold Arbor. 25 : 32 (1944).

Bredia ? *stenophylla* MERR. & CHUN, *Sunyatsenia* 5 : 146 (1940). Type : *Liang* 62530, Hainan, Yai-chow (lecto-, A, photo C); isolecto-, E, G, photo NY).

Shrub, 2-3 m high, branched, glabrous except for very sparse minute glands on both leaf surfaces. Branchlets quadrangular, 4-ribbed or 4-winged. Petiole 4-12 mm long. Leaf blade elliptic, 5-8.8 × 1.2-2 cm; base acuminate or cuneate, apex acuminate, margin entire or subserrulate on distal half, revolute or not; more or less distinctly 3-plinerved with lateral nerves diverging up to 6 mm from base. Flowers unknown. Fruits solitary or 2-3 together; peduncle ca. 2.5 mm long; bracts 2, narrowly ovate, sessile, 5-10 × 1.5-2 mm, persistent in fruit; pedicel 10-15 mm long. Fruit cup-shaped, subquadrangular, 8-ribbed, ca. 6.5 × 4.5 mm, valves flushing hypanthium, old fruit cup-shaped, 7 × 4.5 mm, placental column unbeaked, horns slender, ca. 0.6 mm long, curved inwards, placentas thready. Seeds unknown. — Fruits and old fruits in August and October. — Fig. 5, *E*.

HABITAT : Along stream in forest, altitude unknown.

DISTRIBUTION : China (Hainan). — Fig. 18, *A*.

SPECIMENS : *Liang* 62530, type (A, E, G), 63384 (A, K).

NOTES : *Phyllagathis stenophylla* belongs to the species with no indumentum other than minute glandular hairs. It resembles *P. setotheca*, but becomes 2-3 m high, and differs also in having the flowers solitary or at most three together, in the absence of hairs in between the

pedicels, and in having only two small narrow bracts not forming an involucre. See also notes under *P. melastomatoides*.

In the shrubby habit, the narrow leaves, and the few flowers it resembles *P. suberalata*. It differs from that species in having short and widely attenuate sepals as seen in the mature fruits of *Liang 62530*.

19. *Phyllagathis fengii* C. Hansen

Nordic J. Bot. 10 : 23 (1990).

Cyphotheca hispida HU, J. Arnold Arbor. 33 : 167 (1952).

— *Phyllagathis hispida* (HU) WU, Fl. Yunnanica 2 : 114 (1979), non KING (1900). Type : *Feng 11746*, Yunnan, Si-chour-hsien, Faa-doou (holo-, A, photo C).

Herb, 90 cm high. Stem subquadrangular, with dense appressed 0.5-1.5 mm long whitish bristles when young, glabrescent when older. Petiole 0.5-5 cm long, clothed as stem. Leaf blade ovate, 6.5-12 × 3-4.5 cm; base subcordate, apex acuminate, margin entire with bristles as surfaces; 3-5-nerved, above with sparse 0.5-1.2 mm long bristles, and below with 0.1-1 mm long bristles on lamina and dense appressed to 1.5 mm long bristles on longitudinal nerves. Inflorescence a few-flowered umbel, 3 cm long; peduncle 0.9 cm long, clothed as stem; bracts ovate, 1 mm long, with a few bristles; pedicel 9 mm long in flower, clothed as stem but much sparser. Hypanthium cup-shaped, ca. 3 × 2.5 mm, with sparse minute brown glands and sparse to 1.3 mm long subappressed bristles. Sepals ligulate, 3.2 × 1.5 mm, acute apically, clothed as hypanthium. Petals suborbicular, ca. 7 × 6 mm, ciliate from short gland-tipped hairs on the margin. Stamens 8, polymorphic in size; filaments 4.5-5.5 mm long, flat, with a few minute uni-seriate gland-tipped hairs; anthers narrowly ovate, slightly curved forward, largest ones 4.7 mm long, smallest ones 2.2 mm, connective ridge-like, ending abruptly basally, inconspicuous ventrally. Ovary insufficiently known; crown lobes large, sinuate, margin incised, each tooth ending in a gland-tipped hair. Style 10 mm long, with sparse minute gland-tipped hairs on basal half. Fruit and seeds unknown. — Flowers in September. — Fig. 4, K.

HABITAT : Mixed forest at 1450-1550 m. — Fig. 18, B.

DISTRIBUTION : China (Yunnan), only known from the type specimen.

NOTES : *Phyllagathis fengii* can be recognized by the appressed bristles on the stem and petioles and by the ligulate sepals which are as long as the hypanthium. Additional characteristics are the few-flowered umbel of relatively small flowers and the polymorphic stamens.

Among the species known to have ligulate sepals only *P. longicalcarata* shows some resemblance to *P. fengii*. It differs in the patent stem bristles, the filiform hypanthial emergences, and the long-spurred anthers.

Two taxa, *P. dichotoma* and *P. melastomatoides* var. *melastomatoides*, the former known only in fruit, have appressed or subappressed bristles on the stem, at least on the internodes. *Phyllagathis dichotoma* differs in the up to 6 mm long patent nodal bristles. *Phyllagathis melastomatoides* var. *melastomatoides* has up to 4 mm long bristles mixed with short ones, the

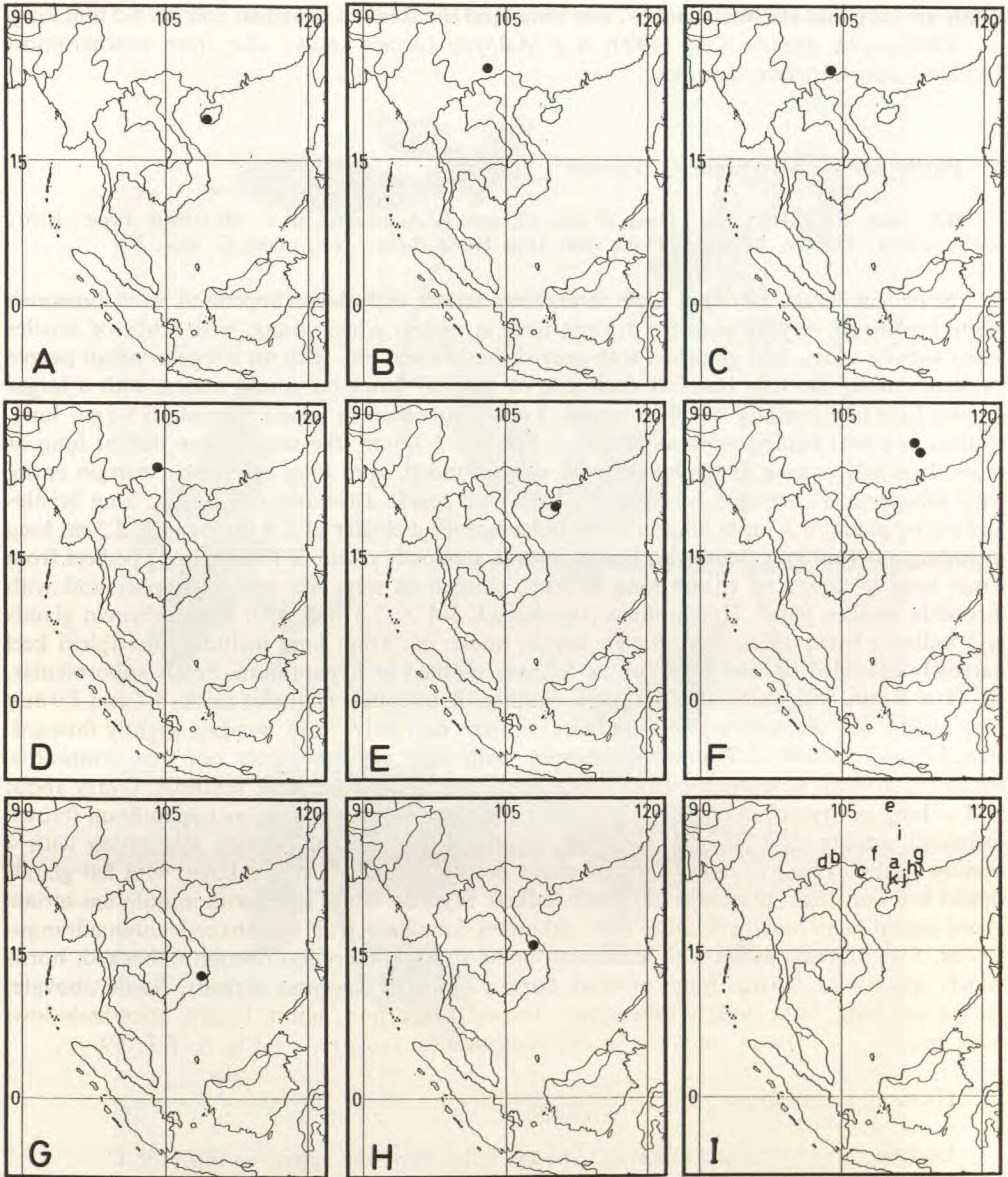


Fig. 18. — *Phyllagathis*, A-H : specific total distributions, I : type localities. A, *P. stenophylla*; B, *P. fengii*; C, *P. tentaculifera*; D, *P. erecta*; E, *P. hainanensis*; F, *P. anisophylla*; G, *P. truncata* and *P. megalocentra*; H, *P. driessenioides*. — I, uncertain species : a, *P. asarifolia*; b, *P. cymigera*; c, *P. deltoda* and *P. longiradiosa* var. *pulchella*; d, *P. hispidissima*; e, *P. latisepala*; f, *P. longearistata*; g, *P. elattandra*; h, *P. nudipes*; i, *P. plagiopetala*; j, *P. setotheca* var. *setotuba*; k, *P. ternata*.

sepals are long and attenuate and 6-7 mm long, and the stamens subequal and ca. 6.5 mm long.

Phyllagathis hispida King (1900) is a Malayan species known also from southernmost Thailand and northern Sumatra.

20. *Phyllagathis tentaculifera* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 40 (1990). Type : *Henry 10456*, China, Yunnan, Mengtse, Ti-ma near Iken Hsien (holo-, NY, photo C; iso-, K).

Branched shrub, 30-60 cm high. Branchlets terete, with dense appressed stout brownish white bristles of varying sizes (to 1.5 mm long at nodes) when young, with stubs of bristles when slightly older, and glabrous with greyish bark when old, with an irregular small purple swelling among the hair bases at each side of the leaf bases on young nodes, with a larger greyish lobe-like swelling on older nodes. Leaves subequal in a pair; petiole 0.5-2 cm long, clothed as stem; blades ovate to elliptic, 3.5-9 × 1.3-3.5 cm, the smaller one half as long or more than half as long as the longer one; base rounded, apex long acuminate, margin entire with subappressed bristles; 3-5-nerved, above with sparse ascending 0.8-1.5 mm long bristles and below patent 0.3-1 mm long bristles. Inflorescence a cluster of 2-4 flowers, ca. 2.5 cm long including a 0.4 cm long peduncle; bracts several, narrowly ovate, 2-10 mm long; pedicel from 6 mm long in flower to 15 mm long in fruit, clothed as stem but bristles sparser and with distinctly swollen bases. Hypanthium cup-shaped, 3-4 × 2.5 mm, with minute brown glands and bulbous-based ascending bristles. Sepals linear, ca. 8 mm long including an apical keel narrowly extended beyond apex for ca. 1.5 mm, clothed as hypanthium. Petals suborbicular, ca. 11 × 9 mm, with apiculate apex, pink. Stamens 8, unequal; filaments thick, 3.7 and 3.9 mm long, with a few uni-seriate glandular hairs; anthers narrowly ovate, bending slightly forward, straightening apically, 2.7 and 3.6 mm long, with base of anther sacs not free, connective thickened towards base, with a short stout dorsal spur, inappendiculate ventrally. Ovary about half as long as hypanthium (crown excluded) and three fourths as long as hypanthium (crown included), adnate to it for about half its length; 4 deep anther pockets alternating with 4 shallow (none to base of ovary), top of ovary deeply depressed; crown large, with flat gland-tipped hairs on edge; placentas narrowly stalked. Style ca. 6 mm long, with minute uni-seriate gland-tipped hairs basally. Mature fruit unknown, immature fruit cup-shaped, subquadrangular, ca. 5 × 5.5 mm, valves with accrescent hairs on edge, placental column unbeaked, horns widely spaced, ca. 0.6 mm long, pointed, curved inwards, placentas thready. Seeds obovate, ca. 0.6 mm long, testa slightly tuberculate, brown, beak short, blunt, brown, strophiole low, dark brown. — Flowers and nearly mature fruits in January. — Fig. 4, I-J; 19.

HABITAT : Old forest.

DISTRIBUTION : China (Yunnan), known only from the type. — Fig. 18, C.

NOTES : *Phyllagathis tentaculifera* is a shrub with greyish bark, with dense appressed bristles on young branches, with lobe-like swellings at nodes, with short-pedunculate few-flowered clusters of flowers, and with a stout elevated anther connective. It can be recognized



Fig. 19. — *Phyllagathis tentaculifera*, holotype.

immediately by the long and narrow sepals with appressed bristles. Only *P. suberalata* has as long and narrow sepals, but they are without bristles. Conspicuously elevated connectives have been observed elsewhere only in *Aschistanthera*, *Cyphotheca*, and *Tylanthera cordata* (HANSEN 1987b; 1989a, b). The mature fruit is characteristic in the accrescent hairs on the edges of the valves.

21. **Phyllagathis erecta** (S. Y. Hu) C. Chen

Bull. Bot. Research 4 : 41 (1984).

Stapfiophyton erectum S. Y. HU, J. Arnold Arbor. 33 : 174 (1952). Type : *Feng 13082*, China, Yunnan, Mar-li-po, Hwang-jin-in (holo-, A).

Little-branched herb, 60 cm high, with no indumentum on vegetative parts other than minute brown glands. Stem subquadrangular and densely clothed when young, soon becoming terete and glabrous. Petiole 1.5-2.5 cm long. Leaf blade elliptic, 9-13 × 3.5-5 cm; base acute, apex long acuminate, margin entire; 3-plinerved with nerves diverging 1-3 mm above base, glabrous above. Inflorescence a thyrse, 8 cm long, with branches at about four nodes, basal ones 1.2 cm long, forking into two 0.2 cm long branches, other branches not forked, flowers clustered at the end of rachis and branches in no distinct pattern; peduncle 3 cm long; bracts absent; pedicel ca. 5 mm long in fruit. Flowers unknown. Old fruit 4-merous, cup-shaped, with 8 broad rounded ribs, ca. 3.5 × 3.5 mm, placental column unbeaked, with four very short bluntly conical widely spaced horns, placentas thready. Seeds unknown. — Old fruits in November. — Fig. 6, E.

HABITAT : Mixed forest at 1300-1500 m altitude.

DISTRIBUTION : China (Yunnan), only known from the type. — Fig. 18, D.

NOTES : *Phyllagathis erecta* has a thyrsoid inflorescence with no indumentum other than minute brown glands. A good characteristic in the old fruit is the unbeaked placental column and the short widely spaced horns.

22. **Phyllagathis hainanensis** (Merr. & Chun) C. Chen

Bull. Bot. Research 4 : 42 (1984).

Bredia hainanensis MERR. & CHUN, Sunyatsenia 5 : 145 (1940). Type : *How 72967*, Hainan, Po-ting (holo-, A).

— *Plagiopetalum hainanense* (MERR. & CHUN) LI, J. Arnold Arbor. 25 : 10 (1944).

Dichotomously branched shrub, 20-25 cm high, with an indumentum on vegetative parts and hypanthium and sepals of appressed bent or patent inflated whitish uni-seriate hairs tipped with a brown glandular cell, dense on distal stem and inflorescence branches, and, usually only in inflorescence, of patent 0.5 mm long hairs tipped with a narrow elongate purplish gland (see also leaf margin). Stem subquadrangular, sometimes sulcate on two

opposed sides and ribbed when older, greyish. Petiole 0.5-1.5 cm long, sometimes 3-ribbed below from decurrent main ribs. Leaf blade ovate, 3-5.5 × 1.2-3.7 cm; base rounded, apex acute to shortly acuminate, margin serrulate, each tooth passing into a very short stout appressed bristle; 3-nerved. Inflorescence a small few-flowered thyrses, 3-4.5 cm long, with lateral branches at 1(-2) nodes; peduncle 1.5-3 cm long; basal pair of bracts narrowly ovate, ca. 7 × 2 mm, other bracts linear or subulate, 2 × 0.3 mm or less; pedicels from 4 mm long in flower to 6 mm long in fruit. Hypanthium slightly campanulate, ca. 5 × 2.5 mm. Sepals triangular, ca. 1.7 mm long, hardly keeled. Petals insufficiently known. Stamens 8, equal; filaments ca. 4 mm long; anthers narrowly ovate, slightly curved forward, ca. 3 mm long, yellow, connective with a short blunt dorsal spur and two ventral tubercles; pore small. Ovary about half as long as hypanthium (crown excluded) and three thirds as long as hypanthium (crown included), adnate to it for most of its length, anther pockets shallow; crown with eight ca. 0.2 mm long narrowly club-shaped hairs (or glands?) on the inside just below the edge; placentas slenderly stalked. Style ca. 6.5 mm long. Mature fruit unknown, old fruit ca. 4 mm long, beak of placental column with 4 long forking and slightly branching vascular bundles radiating just below the apex, placentas thready. Seeds unknown. — Buds and flowers in May and June. — Fig. 4, *D*; 6, *C*.

HABITAT : Rocks in forested ravine at 700 m altitude.

DISTRIBUTION : China (Hainan). — Fig. 18, *E*.

SPECIMENS : *How* 72967, type (A); *Lau* 26857 (US).

NOTES : *Phyllagathis hainanensis* is a small shrub with forking shoots, grey bark, serrulate leaves, and small thyrses. It can be recognized by the whitish indumentum of inflated uniseriate hairs, dense on the petioles, distal stem, inflorescence branches, hypanthium and sepals, and distally also of patent hairs with an elongate purplish gland; and by the long vascular bundles radiating just below apex of the beak of the central column in the old fruit. The eight club-shaped hairs on the inside of the ovary crown are an additional characteristic.

Except for the colour the indumentum of *P. hainanensis* resembles that of various *Bredia* species (*B. fordii*, etc.). CHEN'S (1984) transference of the species to *Phyllagathis* is here accepted mainly because of its stamens and the old fruit which, however, is not strictly phyllagathoid. Apparently the beak is not 4-horned, but is peculiar in the vascular bundles mentioned above. Their origin cannot be explained until fruits in younger stages are available for study.

In *How* 72967, the older of the two available specimens, the three main ribs of the leaves are distinctly decurrent on the petiole below.

23. *Phyllagathis anisophylla* Diels

Bot. Jahrb. Syst. 65 : 115 (1932). Type : *Hunan Museum* 60, [copied from protologue :] Prov. Hunan meridion., *loco non indicato, aest.*, 1926 (not seen).

Phyllagathis oligotricha MERR., *Sunyatsenia* 1 : 74 (1930). Type : *Tso* 21016, Kwangtung, Lok Chang (holo-, NY).

Shrublet, ca. 35 cm high. Stem terete, clothed with minute uni-seriate gland-tipped hairs, glabrous when older. Petiole 0.5-3 cm long, with 1-1.5 mm long patent gland-tipped hairs distally along sulcus. Leaf blade broadly ovate, 3.2-9.5 × 2-6.5 cm; base broad, rounded to subcordate, apex broadly shortly acuminate, margin entire, distantly ciliate; 3-5-nerved, above and below with minute uni-seriate gland-tipped hairs, above also with sparse ca. 1 mm long gland-tipped hairs, thick on basal half. Inflorescences 3-5 together in a seriate arrangement, 1-3 cm long, each ending in an umbel-like cluster of flowers or the middle one in a contracted thyse, clothed like the stem with a few patent less than 1 mm long gland-tipped hairs; peduncle 0.5-1.5 cm long; bracts subtending cluster of flowers 2, elliptic, 4.5 × 1.5 mm or usually much less, bracteoles subulate, less than 1 mm long; pedicel ca. 3.5 mm long in flower, up to 7 mm long in fruit. Hypanthium campanulate, ca. 3 × 2 mm, with minute brown glands and sparse patent ca. 1 mm long gland-tipped hairs. Sepals low and very broadly acuminate, ca. 0.8 mm long. Petals broadly asymmetrically obovate, ca. 4 × 3 mm, reddish. Stamens 8, slightly unequal; filaments flat, ca. 3.5 and ca. 4.5 mm long; anthers slightly curved to ventral side, ca. 3.5 and ca. 4 mm long, yellow, connective dorsally with a flat blunt grooved pendant ca. 0.4 mm long spur, ventrally inappendiculate. Ovary, length, adnation and anther pockets not observable; crown distinct, slightly wide, lobes fully connate, with minute brown glands on edge; placental stalks compressed. Style ca. 7 mm long, with a few patent uni-seriate gland-tipped hairs on basal half. Old fruit cup-shaped, ca. 4 × 4 mm, placental column with an 0.5 mm long beak, placentas not thready. Seeds cuneate, angular apically, ca. 0.7 mm long, testa tuberculate at angles, otherwise smooth, light brown, beak as wide as seed body, inflated, pale brown, strophiole brown. — Buds, flowers and very old fruits in June.

HABITAT : Unknown.

DISTRIBUTION : China (Kwangtung). — Fig. 18, *F*.

SPECIMENS : *Tso 21016*, type of *P. oligotricha* (NY). The type of *P. anisophylla* (*Hunan Museum 60*) has not been available.

NOTES : *Phyllagathis anisophylla* can be recognized by its seriate arrangement of the inflorescences, by the dorsally long-spurred and ventrally minutely tuberculate anthers, by the non-thready placentas, and by the entire beak of the placental column. The thick basal half of the hairs on the upper surface of older leaves is an additional characteristic.

The normal-sized leaves at the terminal node subtend what has been interpreted as three or five inflorescences arranged in a seriate way. The larger middle one looks like a much contracted thyse, and the smaller outer ones are umbellate or 1-3-flowered. Together they look like a single inflorescence, but have not been interpreted as such because of their seriate arrangement. *Phyllagathis anisophylla* is somewhat out of place in *Phyllagathis* because of the inflorescence, non-thready placentas and entire beak. It agrees with *Phyllagathis* in having a persistent basal half of the hypanthium and in having wedge-like valves surrounding an obpyramidal space in the old fruit. There is no other genus available for it, and it is not sufficiently distinct to be placed in a genus of its own.

The only material studied of *P. anisophylla* is the holotype of *P. oligotricha* which agrees with DIELS's description in many details. See also *P. nudipes* C. Chen, p. 423.

24. *Phyllagathis truncata* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 40 (1990). Type : *Poilane* 6544, Annam, nord de Ninh Hoa pr. Nhatrang, versant sud-ouest du massif de la Mère et l'enfant (holo-, P, photo C).

Branched herb or shrublet, subdecumbent (according to label notes), 50 cm high, with minute brown glands on all parts and an additional indumentum of sparse hairs only on leaves. Stem subquadrangular when young, terete when older, slightly 4-ribbed, with an elevated spot on each side of the leaf bases. Petiole 4-5 cm long, V-shaped in cross section. Leaf blade broadly elliptic to obovate, 15-17 × ca. 7 cm; base acute, apex shortly acuminate, margin entire or subserrulate distally, with sparse forward bending hairs; 3-nerved, above and below with sparse to 1 mm long hairs. Inflorescence a simple dichasium, ca. 13 cm long; peduncle ca. 11 cm long; bracts unknown (scars present); pedicel 8 mm long in bud. Hypanthium turbinate, ca. 4.5 × 3 mm, thick-walled, tough, with minute brown glands. Sepals connate into a ca. 2.5 mm high widening truncate rim with four large acute-angled triangular wings on the outside, clothed as hypanthium. Petals suborbicular, but asymmetrical due to uni-lateral emargination, ca. 13.5 × 14.5 mm, thick, tough, pink. Stamens 8, equal; filaments flat, ca. 7 mm long; anthers narrowly ovate, curved to ventral side, ca. 9 mm long, connective dorsally extended into a stout upwards curving ca. 2 mm long terete spur, ventrally into two laterally compressed lobes, slightly incised on lower edge, adnate to base of anther sacs, slightly exceeding them, pore truncate. Ovary two thirds as long as hypanthium (crown excluded) and slightly exceeding hypanthium (crown included), adnate to it for half its length, anther pockets to base; crown of four thick connate lobes, wide. Style ca. 14.5 mm long. Fruit and seeds unknown. — Buds in May. — Fig. 2, B; 4, A; 20.

HABITAT : On black rocky poor soil in poor forest at 1800 m altitude.

DISTRIBUTION : Vietnam (Annam), known only from the type. — Fig. 18, G.

NOTES : *Phyllagathis truncata* and the following species, *P. driessenioides*, probably are closely related. There is a general likeness between them, and they agree in having few ordinary hairs, in their large leaves, in having a simple dichasium, and in their turbinate hypanthium with the sepals connate into a high, spreading, winged rim. Generally they do not resemble the other species, and they have been referred to *Phyllagathis* only with hesitation. The stamens, however, fall within the range of variation of that genus, and because there is no other genus to which they may obviously be referred, they have so far been accepted in *Phyllagathis*. When fruits become known they may be decisive for the generic affinities of the two species.

Phyllagathis truncata has deeply sulcate petioles, a long-pedunculate dichasium, a non-ribbed hypanthium, and lobe-like ventral staminal appendages. *Phyllagathis driessenioides* has only slightly sulcate petioles, a sessile dichasium, a ribbed to winged hypanthium, and filiform ventral staminal appendages.

The elevated spots on the nodes appear to be lenticels.

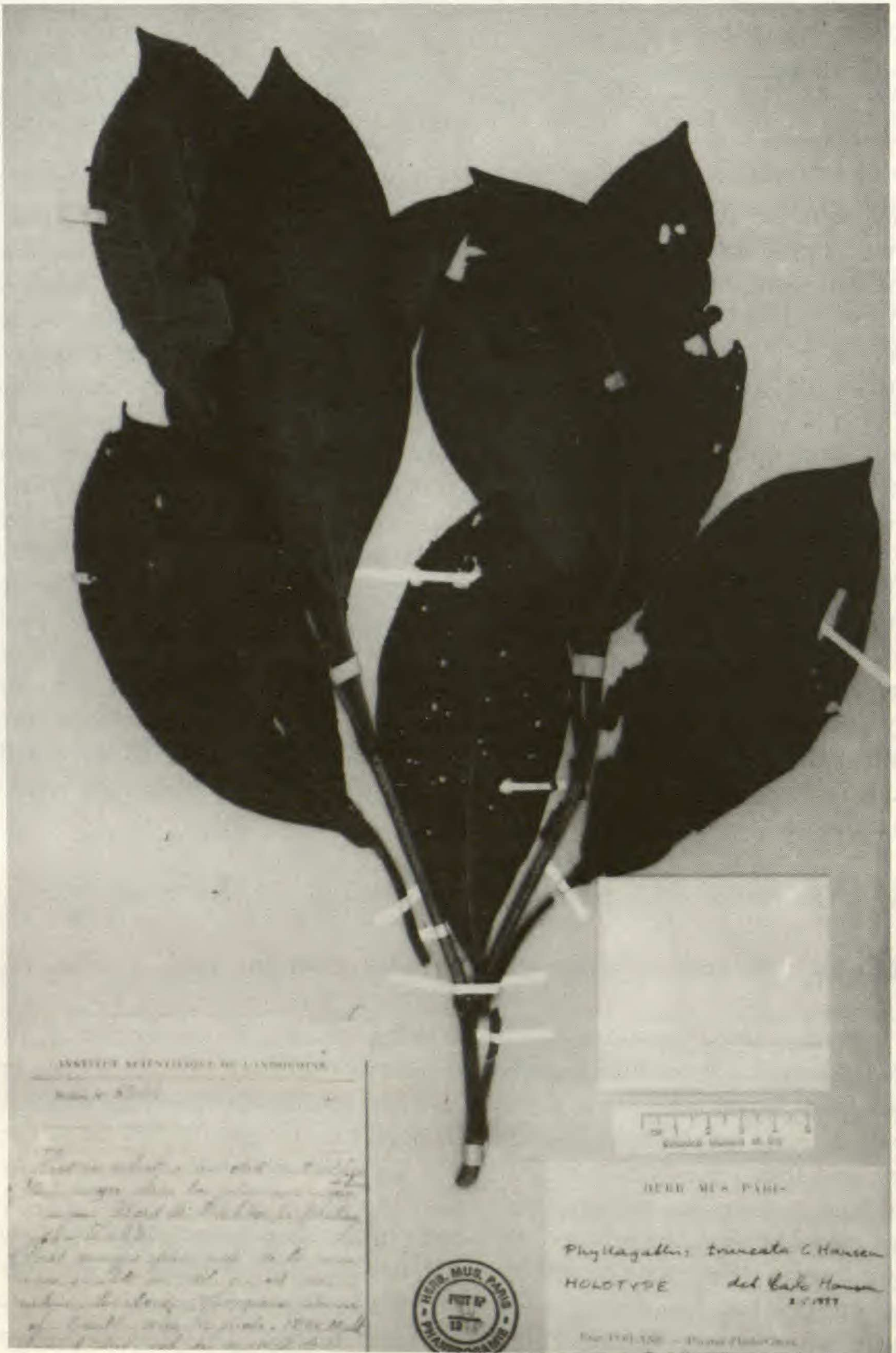


Fig. 20. — *Phyllagathis truncata*, holotype.

25. *Phyllagathis driessenioides* C. Hansen

Bull. Mus. Natn. Hist. Nat., Paris, 4^e sér., 12, sect. B, Adansonia, n° 1 : 39 (1990). Type : *Poilane 31882*, Annam, confin sud de la province de Qangnam entre les villages Moï de Hang-Tra et Dac-Ao (holo-, P, photo C).

Branched shrublet, 1-2 m high, with no indumentum other than minute brown glands, dense on stem and inflorescence branches, sparse or absent elsewhere. Stem subquadrangular when young, terete when old. Petiole 2.5-3.5 cm long, subterete with a slight sulcus above. Leaf blade very broadly ovate, 17.5-21.5 × 10-13 cm; base broadly rounded to subcordate, apex shortly acuminate, margin entire; 3-5-nerved. Inflorescence a simple dichasium, ca. 2 cm long; peduncle flat, ca. 5 mm long; bracts unknown (scars only); pedicel 5 mm long in bud. Flowers known only in bud. Hypanthium turbinate, ca. 6 mm long, quadrangular, ribbed to winged from decurrent sepalous wings, thick-walled, tough. Sepals connate into a conspicuous wide rim, ca. 2 mm high at sinus and ca. 2.5 mm high at lobes, each lobe with a large obtuse-angled triangular wing. Petals very thick in bud, whitish. Stamens 8, most likely equal; anthers ca. 4.5 mm in bud, connective dorsally extended into a ca. 1.5 mm long narrow tapering spur and ventrally into two filiform ca. 1.5 mm long appendages. Ovary adnate to hypanthium for its whole length (crown excluded), anther pockets to base of ovary almost meeting there. — Buds in February. — Fig. 2, A; 4, C; 21.

HABITAT : Granitic soil in old forest at 1500-1800 m altitude.

DISTRIBUTION : Vietnam (Annam). — Fig. 18, H.

SPECIMENS : *Poilane 31799* (P), *31882*, type (P).

NOTES : The filiform ventral staminal appendages are unique in *Phyllagathis*. In bud they are one fourth the length of the anther. — See also under *P. truncata*.

26. *Phyllagathis marumiaetricha* (Guill.) C. Hansen, *comb. nov.*

Medinilla marumiaetricha GUILL., Bull. Soc. Bot. France 68 : 6 (1921). Type : *Eberhardt 3056* (the protologue gives *3036*, probably a typographic error since no EBERHARDT specimen of the present species is numbered *3036*), Indochine, prov. de Thua-thien, haute vallée du Song Thuy-Cam (lecto-, P).

Branched shrub to 3.5 m high, with no indumentum of any kind except in inflorescence. Stem terete. Petiole 3-4.5(-6) cm long. Leaf blade broadly elliptic to obovate, 13-17 × 5.5-11 cm; base acute, cuneate, or acuminate, apex acuminate, margin entire; 3-5-plinerved with middle pair or nerves diverging up to 2 cm from base. Inflorescence a sessile umbel; bracts ovate to obovate, 4.5-8 × 3-5 mm, or outer pair sometimes leaf-like and up to 30 × 10 mm, with often dense stellate hairs; pedicel from 10 mm long in flower to 35 mm long in fruit, with



Fig. 21. — *Phyllagathis driessenioides*, holotype.



According to the protologue Eberhard
3036 is the type of *Medusa marumia-*
tricha Eberhard 3086 however is the
only Eberhard material present under
that name in Paris. I therefore assume
that "3036" in the protologue is a mistake
for "3086" and Eberhard 3086 consequently
becomes the type. Earl Hanson
12. 92

Phyllagathis marumiaetricha
LECTOTYPE of (Eberh.) G. Hanson
Medusa marumiaetricha DC. *Sida* DC.
1817, 1842



HERBIER EBERHARDT
INDOCHINE

HERB. MUS. PARIS

Phyllagathis marumiaetricha (Eberh.) G. Hanson
Sida DC. 1842
Sida DC. 1842
Sida DC. 1842
Sida DC. 1842
Sida DC. 1842

Fig. 22. — *Phyllagathis marumiaetricha*, holotype.

stellate hairs. Hypanthium cup-shaped, 10×7.5 mm, thick-walled, with patent 4-6 mm long dark emergences all unbranched or upwards forked or more branched with branches ending in a light stout hair, hypanthium also with stellate hairs both on surface and on emergences. Sepals with their bases connate into a 3 mm high rim, lobes themselves suborbicular due to a constriction at transition to rim, ca. 5×5 mm, with a conspicuous midrib, reflexed apically, with marginal hairs and some stout hairs or reduced emergences basally on midrib, rim persistent in mature fruit, lobes not. Petals narrow and slightly asymmetrically obovate, 20-25 \times ca. 6 mm, acuminate, thick at middle, uneven on both surfaces, reddish. Stamens 8, equal; filaments 15.7-18 mm long; anthers long and narrow, tapering, curved backwards apically, 18-20 mm long, connective dorsally with a minute spur and clasping filament in an inconspicuous horseshoe-shaped collar. Ovary half as long as hypanthium (crown excluded) and two thirds the length of hypanthium (crown included), adnate to it for most of its length, anther pockets to base; crown lobes connate for half their length, with thin gland-tipped hairs on edge. Style ca. 23 mm long. Mature fruit slightly urceolate, not ribbed, 12×9 mm, old fruit cup-shaped, 8-ribbed, 11×8 mm, all hypanthium perished (together with the epidermis of the pedicel) except the 8 lignified vascular bundles, central column unbeaked, horns short, acicular, placentas thready. Seeds cuneate, shortly beaked, ca. 0.9 mm long, tuberculate strophiole conspicuous, all parts of seed brown. — Buds and old fruits in February and April, fruits in September. — Fig. 2, *E-F*; 4, *G*; 22.

HABITAT : Rocks and banks of streams in forests on granitic shaly soil at 1000-1200 m altitude.

DISTRIBUTION : Vietnam (Annam). — Fig. 13, *D*.

SPECIMENS : *Eberhardt* 3056, type ("3036") (P); *Poilane* 1014 (P), 27782 (P), 29839 (P).

NOTES : *Phyllagathis marumiaetrica* is a large shrub totally glabrous except for a stellate pubescence on bracts, pedicels, and hypanthium. In addition it can be recognized by the sessile bracteate inflorescence; the characteristic hypanthial emergences; and the peculiar sepals. Also the branching, the large petals, and the old fruit are characteristic.

Minute brown glands have not been observed on any part. The truly stellate pubescence in the inflorescence is unique in the genus. The hypanthial emergences are slender, cylindrical and constricted into a short light-coloured terminal bristle. Rarely also some lateral bristles occur on the distal half of the hypanthium. The emergences often fork or are slightly more branched and each branch ends in a bristle. The emergences of *P. marumiaetrica* cannot be confused with those in other species (see p. 360).

The inflorescence is sessile at the terminal node. Characteristically the branching occurs from the axils of the normal-sized leaves subtending the inflorescence. A new twig (or rarely two) shoots from the narrow space between the inflorescence and each petiole, and usually produces only a single internode before a new inflorescence develops. A few variations from that pattern occur. No lower branching is observable, because all specimens represent only very distal parts of the plant.

The sepals of *P. marumiaetrica* are unique. Their bases are united into a truncate rim. The outer part of the lobes is suborbicular due to a deep constriction at the transition to the rim. Each lobe has as backbone a stout midrib and is much reflexed apically.

In the old fruit the whole of the hypanthium has perished so that the eight vascular bundles are fully exposed.

By virtue of the capsular fruit *P. marumiaetrica* certainly belongs in the *Sonerileae*, where it fits well in *Phyllagathis*. The stellate indumentum of *P. marumiaetrica* and *P. rotundifolia* occurs also in *Cyphotheca* (HANSEN, 1990).

27. ***Phyllagathis megalocentra*** C. Hansen, *sp. nov.*

Herba prostrata, umbellata, parviflora, unico indumento glandularum minutarum fuscarum, foliis suborbicularibus. Appendice staminali dorsali grandi, valido et triangulati atque fructo maturo cum valvis hypanthium ca. 2 mm excendentibus, determinabilis.

TYPE : *Poilane 3584*, Indochine, Annam, Nhatrang (holo-, P).

Herb, 30 cm high, with no indumentum anywhere but minute brown glands, dense on stem, petioles, and peduncles, sparser elsewhere. Stem thick and gnarled, 25 cm long, most of it prostrate, leafless, rooting, only the distal 5 cm erect and leaf-bearing. Petioles 10-20 cm long. Leaf blade suborbicular, 14-18 × 12-16 cm; base subcordate, apex very broadly shortly bluntly acuminate, margin entire; 7-nerved. Inflorescence an umbel, ca. 12 cm long; peduncle ca. 10.5 cm long; bracts unknown (fallen); pedicel from 6.5 mm long in flower to 11 mm long in fruit. Hypanthium cup-shaped, ca. 3 × 3 mm, with thick walls. Sepals low and rounded, ca. 1.5 × 3 mm, spreading with a slight apical keel. Petals broadly obovate, ca. 7 × 5 mm, pinkish. Stamens 8, equal; filaments ca. 6 mm long; anthers narrowly ovate, the tapering apex slightly bent forward, ca. 8.1 mm long, base of anther sacs not free, connective with a large stout pendent ca. 1.4 mm long triangular spur and two blunt rod-shaped ventral ca. 0.8 mm long appendages. Ovary about half as long as hypanthium (crown excluded) and about as long as hypanthium (crown included), adnate to it for about its whole length, anther pockets half-way to base; crown large, lobes connate for half their length. Style 12-15 mm long. Mature fruit cup-shaped, subquadrangular vaguely 8-ribbed, ca. 6.5 × 4.5 mm (including the valves protruding ca. 2 mm), placental column beaked, horns narrow, pointed, only slightly spaced, placentas thready. Seeds obovate, ca. 0.8 mm long, testa tuberculate, brown, beak stout, blunt, pale brown, strophiole brown. — Flowers and fruits in May. — Fig. 2. *C*; 4, *B*; 7, *D*; 23.

HABITAT : On ground in forest at 2000 m altitude.

DISTRIBUTION : Vietnam (Annam), known only from the type. — Fig. 18, *G*.

NOTES : *Phyllagathis megalocentra* is a prostrate herb with no indumentum other than minute brown glands. It can be recognized by the large suborbicular leaves, the hypanthium, the anthers and the fruit.

In general appearance *P. megalocentra* resembles only *P. tetrandra* and *P. subrotunda* (see p. 377). The hypanthium is small and as wide as long with low spreading sepals at the rim. The connective is characteristic because of the large stout spur, which resembles only the spur in *P. longicalcarata*. The mature fruit is characteristic because the wedge-shaped valves exceed the hypanthium by 2 mm.

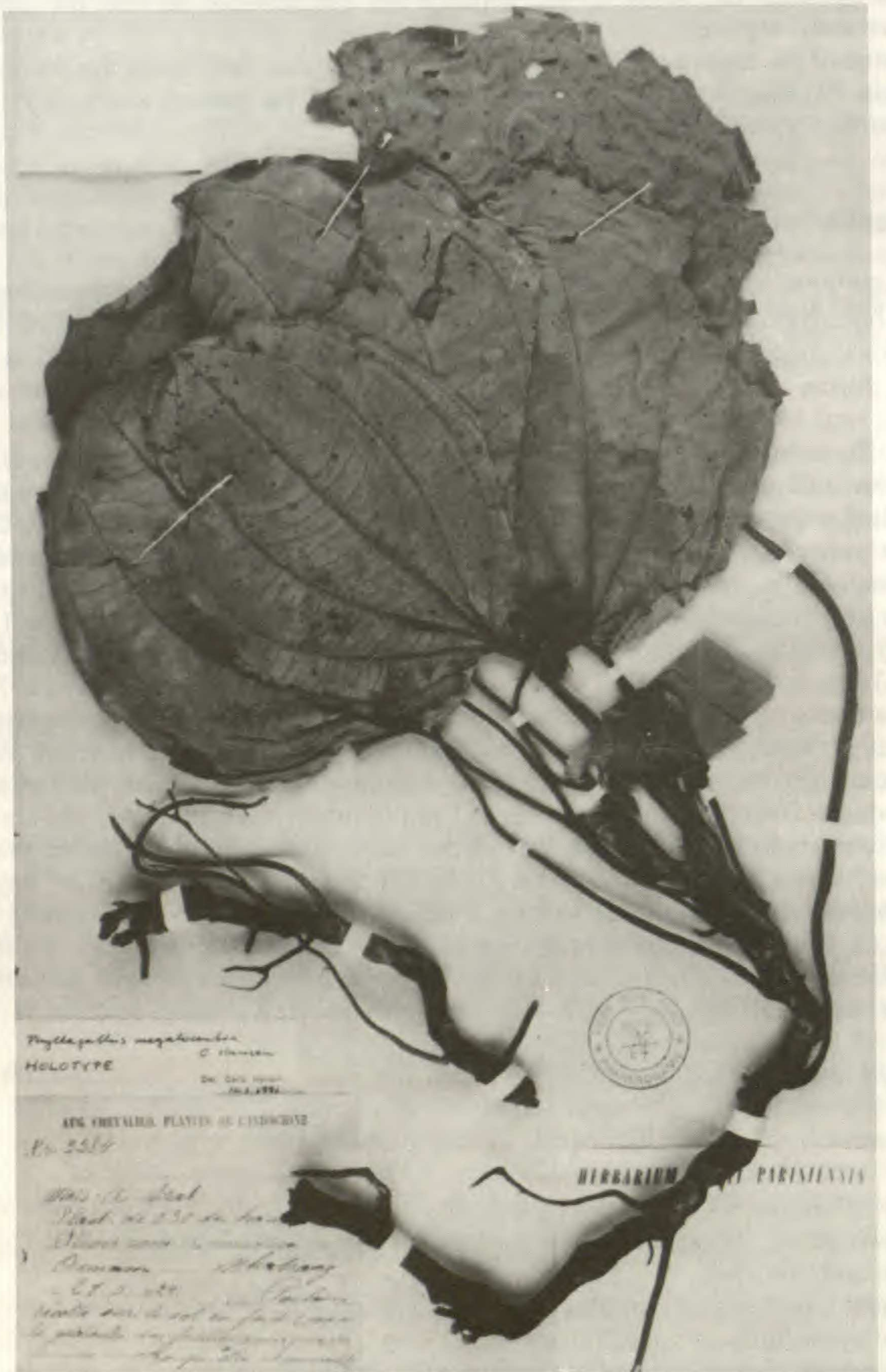


Fig. 23. — *Phyllagathis megalocentra*, holotype.

UNCERTAIN SPECIES AND VARIETIES

28. *Phyllagathis asarifolia* C. Chen

Bull. Bot. Research 4 : 56 (1984). Type : *Wang 39203*, [copied from protologue :] Guangxi ; Pingnan, Yao Shan (holo-, SCBI, photo C, original not seen).

CHEN's description and his illustration (1984*b*) leaves no doubt that *P. asarifolia* belongs to *Phyllagathis*. The anthers and old fruits are truly phyllagathoid. In the subcaulescent, scapose and umbellate habit it resembles only *P. tetrandra*, *P. tonkinensis*, *P. megalocentra*, and *P. subrotunda*, but in regard to the leaves it ranges among all those mentioned in the notes under *P. tetrandra* (p. 377). — Fig. 18, I (a).

29. *Phyllagathis cymigera* C. Chen

Bull. Bot. Research 4 : 41 (1984). Type : *Wu 62-341*, [copied from protologue :] Yunnan : Malipo (holo-, KUN, photo C).

The type shows some general resemblance to *Scorpiothyrsus erythrotrichus* Li and also resembles *Scorpiothyrsus* in having two minute ventral staminal tubercles. It differs, however, from that genus in that the ultimate inflorescence branches are not scorpioid. Unfortunately old fruits are not present that might have helped deciding the generic affinities of *P. cymigera*.

Phyllagathis cymigera is the type species of *Phyllagathis* sect. *Thyrsophyllagathis* C. Chen. Therefore the relationship of that section also is uncertain. — Fig. 18, I (b).

30. *Phyllagathis deltoda* C. Chen

Bull. Bot. Research 4 : 48 (1984). Type : *Soo 68119*, [copied from protologue :] Guangxi : Ningming, Mingjiang (holo-, IBG, not seen).

CHEN (1984*a*) describes a caulescent umbellate plant with a glandulose-pilose indumentum, an indumentum which at once suggests a *Bredia*. Whether his term "connectivo decurrenti" suggests bredioid anthers cannot be told. *Phyllagathis deltoda* may be a good species, but the generic affinities remain uncertain. — Fig. 18, I (c).

31. *Phyllagathis elattandra* Diels

Bot. Jahrb. Syst. 65 : 116 (1932).

— *Stapfiophyton elattandrum* (DIELS) LI, J. Arnold Arbor. 25 : 29 (1944). Type : *Sin 5180*, [copied from protologue :] China merid. : Prov. Kwang tung : Win fu (not traced).

DIELS's type was probably destroyed during the war, and no isotypes have been discovered. Apparently LI (1944) has seen no type specimens either, but cites *Taam 266* as the only representative of the species. It is a specimen in fruit which vegetatively may fit into DIELS's description. Unfortunately it cannot be verified if it agrees in that one whorl of the stamens were rudimentary, nor does DIELS mention if his species has olive seeds, which is the one striking feature of *Taam 266*. Olive seeds have so far been observed only in *Kerriothyrsus tetrandrus*. At present there is no basis for deciding the identity of *Taam 266*, nor the affinities of *P. elattandra*. — Fig. 18, I (g).

32. **Phyllagathis hispidissima** (C. Chen) C. Chen

Bull. Bot. Research 4 : 46 (1984).

Bredia hispidissima C. CHEN in WU, Fl. Yunnanica 2 : 105 (1979). Type : *Mao 4192*, locality etc. in Chinese both in protologue and on label (holo-, HY).

The species has been commented on in the notes under *P. longicalcarata* (p. 393). Its generic affinities remain uncertain. — Fig. 18, I (d).

33. **Phyllagathis latisepala** C. Chen

Bull. Bot. Research 4 : 53 (1984). Type : *Li 6451*, [copied from protologue :] Hubei : Hefeng (holo-, SCBI, photo C, original not seen).

Phyllagathis latisepala and *P. longearistata*, which CHEN compares in the protologue, seem both to be characterized by their widely ovate sepals. CHEN's illustration (1984) also shows that their leaves are plinerved. In *P. latisepala* the flowers are solitary or in pairs, and in *P. longearistata* they are in umbels. Both species belong to *Phyllagathis* or *Bredia*. — Fig. 18, I (e).

34. **Phyllagathis longearistata** C. Chen

Bull. Bot. Research 4 : 52 (1984). Type : *L. H. Chun 91862*, [copied from protologue :] Guangxi : Hechi (holo-, IBG, not seen).

See *P. latisepala*. — Fig. 18, I (f).

35. **Phyllagathis longiradiosa** C. Chen var. **pulchella** C. Chen

Bull. Bot. Research 4 : 52 (1984). Type : *Huang 3596*, [copied from protologue :] Guangxi : Longjin (holo-, GXMI, photo C).

Phyllagathis longiradiosa is treated below under excluded species where it is concluded that it is a taxonomic synonym of *Bredia esquirolii*. The variety *pulchella*, however, represents a

different species. The type specimen does not have the stipitate hyaline glands of *B. esquirolii*. Except for a few short hairs on the leaf margin it does not have ordinary hairs, but only minute brown glands or uni-seriate hairs. *Bredia esquirolii* has ordinary hairs on various vegetative parts, and on the hypanthium it has patent 1-2.2 mm long whitish soft hairs, which may be gland-tipped, and the basal part of which swells in fruit.

The specimen on the figure 42 (1) in CHEN (1984b) looks very much like the type of var. *pulchella*, while CHEN's figures 42 (2-4) look like parts from var. *longiradiosa* (*Bredia esquirolii*), except for the hairy ovary crown.

Neither the study of the type specimen, which is in young bud, nor CHEN's diagnosis has clarified the generic and specific affinities of *P. longiradiosa* var. *pulchella*. — Fig. 18, I (c).

36. *Phyllagathis nudipes* C. Chen

Bull. Bot. Research 4 : 47 (1984). Type : *Lau 73-101*, [copied from protologue :] Guangdong : Wuzhi Shan (holo-, SCBI, photo C, original not seen).

The type specimen, of which I have a photo, shows an overall similarity to the type of *Phyllagathis oligotricha*, which is a synonym of *P. anisophylla* Diels. *Phyllagathis nudipes* most likely is a synonym of that species also, but no decision has been made as flowers and fruits could not be studied. — Fig. 18, I (h).

37. *Phyllagathis plagiopetala* C. Chen

Bull. Bot. Research 4 : 44 (1984). Type : *Tam 63423*, [copied from protologue :] Hunan : Xinning, Ziyun shan (holo-, IBG, not seen).

CHEN's description and his illustration (1984a, b) leave no basis for deciding the affinities of *P. plagiopetala*. — Fig. 18, I (i).

38. *Phyllagathis setotheca* Li var. *setotuba* C. Chen

Bull. Bot. Research 4 : 44 (1984). Type : *Wang 41508*, [copied from protologue :] Guangdong : Yangjiang (holo-, SCBI, photo C, original not seen).

The type agrees in general appearance and in the obovate leaves with *P. setotheca*, but the photograph leaves no basis for evaluating CHEN's diagnostic characters. — Fig. 18, I (j).

39. *Phyllagathis ternata* C. Chen

Bull. Bot. Research 4 : 49 (1984). Type : *Ko 51772*, [copied from protologue :] Guangdong : Xinyi (holo-, SCBI, photo C, original not seen).

Phyllagathis ternata is peculiar in having 3-merous flowers, which are rare in the *Sonerileae* s.l., except in *Sonerila* where they are diagnostic. The type specimen resembles somewhat *P. ovalifolia*, but the photo leaves no basis for ascertaining whether raphides and uni(-pauci-)seriate hyaline hairs, which are characteristic of that species, are present. The stamens of *P. ternata* (CHEN, 1984b : Fig. 46, 2) agree with the stamens of *P. ovalifolia*. — Fig. 18, I (k).

EXCLUDED SPECIES

Phyllagathis chinensis DUNN = *Sarcopyramis napalensis* WALL. (LI 1944; HANSEN 1979).

Phyllagathis erythrotricha MERR. & CHUN = *Scorpiothyrsus erythrotrichus* (MERR. & CHUN) LI.

Phyllagathis fordii (HANCE) C. CHEN = *Bredia fordii* HANCE.

Phyllagathis fordii var. *micrantha* C. CHEN = *Bredia fordii* HANCE.

Phyllagathis gracilis (HAND.-MAZZ.) C. CHEN = *Bredia gracilis* HAND.-MAZZ.

Phyllagathis longiradiosa C. CHEN, Bull. Bot. Research 4 : 51 (1984). — *Barthea cavaleriei* LÉV., Feddes Repert. Spec. Nov. Regni Veg. 8 : 61 (1910), *quoad Cavalerie 1552, non LÉV. & VAN.* (1906). — *Bredia longiradiosa* C. CHEN in WU, Fl. Yunnanica 2 : 105 (1979) *nom. illeg.* (without reference to replaced synonym). — For additional synonyms, see CHEN (1984b). Type : *Cavalerie 1552*, Chine, Mou-You-Se (isolecto-, E).

According to HANSEN (1988c), DIELS (1932) formally designated *Cavalerie 1552*, the last of the original three syntypes of *Barthea cavaleriei*, as the lectotype of that name. The other two syntypes of *Barthea cavaleriei*, *Esquirol 215* and *1581*, respectively are the holotype of *Barthea blinii* LÉV. 1913 (taxonomic synonym of *Plagiopetalum esquirolii*) and of *Barthea esquirolii* LÉV. 1913 (basionym of *Bredia esquirolii*).

In agreement with GUILLAUMIN (1913), but contrary to DIELS's doubt (1932), LAUENER (1972) regards *Cavalerie 1552* to be conspecific with *Esquirol 1581*, and to belong in the genus *Bredia* where only the epithet *esquirolii* is available (*B. esquirolii* (LÉV.) LAUENER). CHEN (1984a) thinks that the specimens are not conspecific and even that they belong to different genera. He retains *Esquirol 1581* in *Bredia* and accepts *B. esquirolii* (LÉV.) LAUENER as the correct name. He transfers *Cavalerie 1552* (type of *Barthea cavaleriei* LÉV. 1910) to *Phyllagathis* where the epithet *cavaleriei* is not available for the species, because of *Phyllagathis cavaleriei* (basionym : *Bredia cavaleriei* LÉV. & VAN. 1906). He names it *Phyllagathis longiradiosa* C. CHEN.

Bredia esquirolii can be recognized by the small patent stipitate spherical glands on the leaves below, usually observable basally, for instance in *Cavalerie 2015* and *Esquirol 3638*. The glands are less than 0.2 mm long with the gland as long as the stipe. They are distinct whenever the head is large yellowish and hyaline. In that stage it looks as if the head has become surrounded by its own exudate. Sometimes, however, the exudate appears to have slid down the stipe onto the leaf surface where it forms a glossy spot, perhaps caused by pressing or some other mechanic influence. Though sparse such stipitate hyaline glands occur on the leaves of *Cavalerie 1552*. Consequently I regard the specimen to be conspecific with *Esquirol 1581*. The

species they represent I accept in the genus *Bredia* in agreement with LAUENER 1972 (see Table 1). Consequently *P. longiradiosa* C. CHEN becomes a synonym of *Bredia esquirolii* (LÉV.) LAUENER. As to *P. longiradiosa* var. *pulchella* C. CHEN, see p. 422.

Phyllagathis tenuicaulis C. CHEN = *Plagiopetalum tenuicaule* (C. CHEN) C. HANSEN (1988c).

Phyllagathis velutina (DIELS) C. CHEN = *Bredia velutina* DIELS.

Phyllagathis xanthosticta MERR. & CHUN = *Scorpiothyrsus xanthostictus* (MERR. & CHUN) LI.

Phyllagathis xanthotricha MERR. & CHUN = *Scorpiothyrsus erythrotrichus* (MERR. & CHUN) LI.

TRANSFER OF STAPFIOPHYTON LI

Fordiophyton peperomiifolium (Oliv.) C. Hansen, *comb. nov.*

Sonerila peperomiaefolia OLIV., Hooker's Icon. Pl. 19 : tab. 1814 (1889).

— *Gymnagathis peperomiifolia* (OLIV.) STAPF, Ann. Bot. (London) 6 : 315 (1892).

— *Stapfiophyton peperomiaefolium* (OLIV.) LI. Type species of *Gymnagathis* STAPF (1892), non SCHAUER (1843).

For discussion, see p. 369.

ACKNOWLEDGEMENTS : Thanks are due to Anne FOX MAULE who translated the diagnosis into Latin, and to the following herbaria who have kindly placed their material at my disposal : A, BM, BR, C, E, G, GXMI, HY, K, KUN, L, M, NY, P, S, UPS, US.

NOTE ADDED BY I. FRIIS (Botanical Museum, Copenhagen)

Carlo HANSEN (1932-1991), curator at the General Herbarium, Botanical Museum, Copenhagen, died of a lung inflammation in Brunei Darussalam, Borneo, on December 7, 1991. He was in Brunei on a mission to study the *Melastomataceae* species of the Batu Apoi Forest Reserve as part of the joint scientific programme of the University Brunei Darussalam and the British Royal Geographic Society Brunei Rainforest Project. Before he went to Borneo, Carlo HANSEN and I had worked on various modifications of this manuscript according to suggestions from the Editor of *Adansonia* and his referees. However, due to the many necessary preparations for the trip to Borneo we did not manage to finish this work completely. After Carlo HANSEN's death, I have tried to finish the task and have, because of my limited knowledge of the *Melastomataceae*, in this work been aided by a specialist on the family, Dr. Susanne RENNERT of the University of Aarhus. Her work with the manuscript is gratefully acknowledged. The editing has been restricted to matters relating to linguistics, general morphology and descriptions of species; the taxonomy is entirely that of Carlo HANSEN.

It should be added that Carlo HANSEN's unpublished genus *Borneothyrsus*, which is mentioned several times in the general part of this text, was intended to include only *Campimia auriculata* (Ridl.) Nayar (basionym : *Allomorpha auriculata* Ridl.), endemic to Borneo.

It is possible that the work on the species of West Malaysia, Thailand and Sumatra can also be published, but it is not at the moment probable that it will be possible to present Carlo HANSEN's work on the *Phyllagathis* species of Borneo in print.

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New species and some important name changes in Malagasy leafy *Cynanchum* (*Asclepiadaceae*)

S. LIEDE

Summary : Six new species and one new subspecies of *Cynanchum* from Madagascar are described. The genus *Pycnoneurum* with two species is included into *Cynanchum*. Typification of *C. subcoriaceum* is clarified and the name found to be a synonym of *C. repandum*. Material commonly referred to as *C. subcoriaceum* is shown to represent *C. obovatum*.

Résumé : Six espèces et une sous-espèce nouvelles de *Cynanchum* sont décrites de Madagascar. Le genre *Pycnoneurum* comprenant deux espèces est inclus dans *Cynanchum*. La typification de *C. subcoriaceum* est clarifiée, et ce nom est mis en synonymie de *C. repandum*. Du matériel habituellement identifié à *C. subcoriaceum* doit être attribué à *C. obovatum*.

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The genus *Cynanchum* L. with ca. 250 species is the largest genus of the subtribe *Cynanchinae* (tribe *Asclepiadeae*, *Asclepiadaceae*). The history of the genus, the continuing difficulties in defining its limits and in the delimitation of subgeneric units have lately been reviewed by FORSTER (1991). If a sectional classification is applied, all of the approximately 120 African species (south of the Sahara) belong to the section *Cynoctonum* (E. Meyer) K. Schum., characterized by the staminal (Cs) and interstaminal corona parts (Ci) forming a highly fused gynostegial corona, C(is) (for details of corona terminology see LIEDE & KUNZE, in press). Particularly fascinating is the diversity of the genus in Madagascar, where about 80 species are found, which display a wide range of different growth forms and floral adaptations. As a first step toward a complete revision of the subtribe for the Flora of Madagascar, 35 leafy species have been delimited, 6 of which, as well as one subspecies, are here described as new. Most of them belong to an exclusively Malagasy alliance of species characterized by a very well developed Ci combined with a hardly developed Cs ('pseudolobe formers', LIEDE & KUNZE, in press, following CHOUX, 1928). All species described here possess white latex; their anther wings consist of a proximal and a distal ridge, with the space between the two ridges densely covered with bristles; the hairs on vegetative parts, if present, are always multicellular. The entrance of the guide rails (two adjacent anther wings which trap an insect's proboscis or leg) can be elevated in height by the following structures, which can occur singly or in any combination. (1) A stipe elevates the gynostegium as a whole, and is commonly covered by coronal tissue. (2) A filament circumscribes the part of the stamen not participating in pollen sack formation. (3) A 'pseudostipe' is the part of the anther not taking part in anther wing formation. During the present revision it has become apparent that the genus *Pycnoneurum*